Volume II

Standard Terminal Automation Replacement System
Human Factors Review
Supporting Documents

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List of Sections

Section 1
STARS Monitor and Control Workstation Human Factors Issues

Computer-Human Interface Issues for the Full Service Level System

Item	SSS	1472D	Priority	Comment
1	3.13.1.3.4.1 3.13.1.3.4.2 3.13.1.3.4.3	Feedback Message Content 5.15.5.8 Color 5.15.3.3.7 Color Coding 5.2.2.1.18	High	There are at least 17 different codes (consisting of combinations of color, blinking, and location) used on the main page of the FSL system. There are 12 colors used (page 18 of manual). There are also at least three further color codes for lettering in windows. There are also two window boundary color codes to indicate if the user has control over the window. There is color coding in data entry fields to indicate whether entry is allowed, not allowed, or incorrect. Some of the color contrast (letters on buttons) may not be sufficient (e.g., yellow on green for TCW failure). This may be too many codes for the operator to learn and use and could lead to confusion and errors.
2		Menu Selection Use 5.15.4.2.1 Consistency 5.15.3.2.4 Minimization of Keying 5.15.2.2.7	High	There are three types of user interfaces in the FSL system: a click-and-point, pull-down menu, and button interface; a simpler key-controlled interface; and a UNIX command window. This requires the user to learn too many interaction styles and is not consistent. The UNIX windows in particular require very complex command syntax. Example: To launch diagnostic tests, users must enter several commands using UNIX command language, which requires extensive training (1472D, Table XXVIII). Once the diagnostic program is launched, the user must switch from using UNIX command language and begin using tabs and the space bar to navigate menus.
3	3.13.1.3.4.6.2	Audio Displays Characteristics 5.3.3	High	The settings for the audible alarm range from 0 to 255. The units are arbitrary. The alarm volume can be turned to zero volume, which means the user may not be notified of an emergency.
4	3.13.1.2.1.2	Computer response 5.15.1.2 System Status 5.15.1.4 Positive Feedback 5.15.2.1.2	High	There is no indication of processing status. For example, several minutes may be required for some diagnostic routines. There is no way for the user to know how much time has elapsed. There may also be no indication that the system is in a diagnostic mode. When analysis is being conducted, there is no feedback to notify the user that analysis has been completed.
5	3.13.1.4.2.2 3.13.1.4.2.3	Data Security 5.15.8.13	High	In the UNIX console window, it may be possible to execute destructive commands such as a disk format. Errors in command entries could involve loss of data or system function.
6		Direction of Contrast 5.2.6.6.4.3.2	High	Some text display windows have white lettering on a gray background. There may not be sufficient contrast for reading.

Item	SSS	1472D	Priority	Comment
7		Error Management Feedback Message Content 5.15.5.8	High	Alarm message acknowledgment is awkward. Messages can be acknowledged all at once, page-by-page from the "Messages" window or one at a time in message box (main display). When the user acknowledges all alarms, it could result in confusion over which message produced the alarm. The user must open the messages list and read through the messages to determine which is responsible. This list does not aid the user in identifying the source of the alarm. From the main monitoring window, users can only view one message at a time. This message must be acknowledged to move to the next message. Users may be forced to acknowledge several less important alarms (without being able to take action) in order to reach a critical alarm. It is likely that important information could be inadvertently lost.
8		Error Management 5.15.8.12 Help 5.15.8.12.1	High	There is no on-line help system available.
9		System Status 5.15.1.4	High	The color of the radar link button did not change to red even though there was a critical failure. Removing a single FSL system LAN connection was not detected by the MCW. Removing both FSL system LAN connections changed the color of the icon to flashing red and light green. Thus, it is possible to lose critical resources without an indication in the MCW.
10	3.13.1.3.4.6.3 3.13.1.3.4.6.5	Discriminability 5.3.4.3 Compatibility 5.3.4.4	High	Audible alarms do not discriminate between alarm conditions. The same auditory alarm is used for all types of alarms and for other informational messages.
11	3.13.1.2.1.2	Feedback 5.15.2.3.8	High	Some actions do not provide feedback when the user reconfigures a screen.
12	3.13.1.2.2.2 3.13.1.2.2.3	Data Change 5.15.2.2.9	Medium	When in a UNIX console window, it is not possible to erase an entry by backspacing over it. This would make it difficult for the user to correct command entries.
13	3.13.1.3.1.1	Display Format Informative Labels 5.15.4.3.14 5.5.6.2.3	Medium	The lines below the Radar Link buttons (in Radar Link window), which indicate status of incoming radar links, are not labeled. When viewing the status of a radar link, the meaning of the two vertical lines is not apparent.
14		Display Format Standardization 5.15.2.3.2 Consistency 5.15.2.3.3	Medium	The Cancel function does not perform the same in all windows. On some windows, it closes the window, but for others, it clears the values in the window with the current focus. Also, Cancel function is only available in some "modification" windows and not others.

Item	SSS	1472D	Priority	Comment
15	3.13.1.3.4.1 3.13.1.3.4.3	Color Coding 5.4.1.4.5.1 Feedback 5.15.5.1	Medium	The area showing the number of unacknowledged messages at the top of the main window shows red flashing with an audible alert if a catastrophic message has been received and shows gray for other error messages. This coding may not be clear about the status or presence of error messages that are not catastrophic failures.
16	3.13.1.2.1.2	Feedback 5.15.2.1.2 5.15.5.7 5.15.5.8 5.15.4.1.14	Medium	In the Tile Modification window, the user tried to modify a value before disabling MSAW. The data entry field turned red, but there was no information as to the nature of the error.
17		Feedback of Erroneous Input 5.15.4.1.14 Field Labels 5.15.4.3.5	Medium	When entering data in fields, there are no guidelines for format. For example, when entering date and time, there is no indication whether colons or slashes are needed. There is also no indication in other entry fields regarding limitations on the size of the entry (e.g., log in). This may lead to unnecessary confusion and errors.
18		Interactive Control 5.15.4.1	Medium	To place a TCW in the test state, assigned airspace must be moved to another station, the TCW must be placed in offline maintenance mode, and a UNIX window opened and the testing software launched. This procedure involves multiple steps and doesn't provide guidance. For example, if the user attempts to take the TCW offline before reassigning airspace, the "Offline Maintenance" option is dimmed, but no indication is provided as to how to remove the workstation for maintenance.
19	3.13.1.3.4.1	Labels 5.15.2.3.9	Medium	Abbreviations such as "POS" are used in several windows, response messages, and tabular displays. This requires the user to remember abbreviations. There often appears to be room for full spelling out of the label.
20		Hierarchical Process 5.15.4.1.7	Medium	When you resize a window, data are often cropped and not wrapped or rearranged.
21		Criticality 5.15.3.1.2	Low	System VSP Control contains a long scrolling list that appears to include functions not required by an M&C operator.
22		Data Entry	Low	The method for modifying parameter values is inconsistent. Some functions have a separate window for making modifications and others do the modification inside the active window.
23		Data Entry	Low	Users have to do too many actions to complete an activity. Once a modification is made and a change is accepted, the user must still click an exit to get out of the window.
24		Display Content	Low	Software that must be launched by the user is contained in separate directories (UNIX level). Releases only can be seen by UNIX command.

Item	SSS	1472D	Priority	Comment
25	3.13.1.3.3.1	Display Format Labels & Titles 5.15.3.1.9	Low	Window Titles: • Windows have two titles. One on the top border and one inside the window. • Some windows have two titles, which are not the same. • Not all window titles are in title case. Some words in a title start with lower case letters.
26		Display Format	Low	Not all labels and data fields are aligned left (e.g., parameter value modification).
27		Display Format	Low	There is no way to distinguish between manual data entry boxes and those with a drop-down menu. The pop-up menu and manual entry provide no indication which type of entry is required. Without distinguishing features, the operator may not be able to tell which kind of data entry is permitted, leading to unnecessary actions and errors.
28		Error Management	Low	Response message areas are sometimes unnecessarily large. Response messages are sometimes in mixed case, sometimes upper case. This could be understood to indicate different types of messages.
29	3.13.1.2.1.2	Feedback	Low	The system beeps when an out-of-range value is entered (sometimes). Sometimes, when an ineligible entry was entered (e.g., "c" when only "a" or "b" were options), the system would beep after "Modify" was clicked or the "Enter" key was pressed. There appeared to be some inconsistency to the range checking /feedback process.
30	3.13.1.2.1.2	Feedback	Low	After changing a setting in the system, a warning window often appears saying, "Configuration will change!" This is not very informative and does not request a confirmation of the previous entry.
31		Free-moving XY	Low	Mouse click response time is slow. There is a delay of acceptance when the mouse is clicked on the exit button in a window. If the mouse is moved out of the window too fast, the action is not accepted.
32		Error Correction 5.15.8.1	Low	In the "Tile Modification" window, there are two initial selectable options. If the wrong one is chosen, the user must close and reopen the window to make a new selection. This adds unnecessary steps to the interaction.
33		Graphic Interaction	Low	Unnecessary information is displayed. For example, the XY coordinates of windows are shown as they are moved.
34		Graphic Interaction	Low	In VSP and other similar windows, a list of accessible control items is shown. Selecting one of these brings up another window where only one value can be changed. This creates unnecessary interactions.

Item	SSS	1472D	Priority	Comment
35		Log On/Off Procedures	Low	It may be possible for a specialist to log in at a supervisory level and be vulnerable to having someone else log in at a lower level, thus revoking the earlier log-in. This might prove confusing if several people are using the system concurrently. Some commands seem to be available even though they cannot be accessed at the current log-in level. This might lead to confusion regarding system operation.
36		Log-on/off Procedures	Low	UNIX commands are required to log in to remote TCWs. The alias that is available to terminate remote processing (cds/killall) is nonfunctional. Super user rights are needed to terminate and restart the processes in the remote TCW.
37		Menu Selection	Low	One of the main commands, "Authorization," has no sub-menus and is not consistent with the others.
38	3.13.1.3.2.1	Data List	Low	Tabular data displays: • Tables do not have consistent text justification. Some columns are left-justified, some are right-justified, and some are centered (e.g., RTQC Registration Control Report window). • Some columns are not evenly spaced (e.g., System VSP Control window). • Some column headings are crowded together, such as "1/512NM."
39		Data List	Low	System Messages (located at the top of the monitoring screen) are not labeled.
40		Data Display Distinctiveness 5.15.4.5.3	Low	Labeling: • Missing labels. Some groups and items have missing labels. For example, the data recorders and LAN lines. • Label location. Labels are not located in a consistent manner. • Not all labels are unique. The primary and redundant RDPS (A or B) and Local MCW (1 or 2) systems are labeled identically and the user must look to the button to determine which system it represents.
41		Data Entry Standardization 5.15.3.2	Low	Data entry fields behave differently but appear the same. Some fields accept manual text entry, whereas others only accept preselected entries from the pop-up menu.
42	3.13.1.3.4.7.3	Display Coding	Low	The flash rate of blink coding is not adaptable.
43	3.13.1.3.4.8	Display Coding	Low	The brightness coding of displayed objects is not adaptable.
44	3.13.1.3.4.1 3.13.1.3.4.3	Feedback Use 5.15.5.1	Low	When running diagnostics, button color remains the same.

Item	SSS	1472D	Priority	Comment
45	3.13.1.3.4.1 3.13.1.3.4.2	Standardization 5.15.3.2	Low	Window labels are color coded but not consistently. White labels are used for fields that allow text entry. Blue labels are used for fields that have information filled automatically by the system. However, sometimes blue labeled fields are editable (e.g., Tile Modification).

Computer-Human Interface Issues for the Emergency Service Level System

Item	SSS	1472D	Priority	Comment
1		System Status 5.15.1.4 5.15.5.1	High	It is difficult for the operator to determine details of status from the main display. Though radar failed, there was no indication at the top level monitoring screen because radar was coming from a second site (the workstation icon remained green). A user would have to navigate to system status to find out that data from one radar were missing. Furthermore, Radar Link status is not monitored.
2		Audio Displays 5.3.1.1.d Warning Signals 5.3.2.1	High	No audible alarms are used in the ESL system. If a user is distracted from the display, there is no cue to call attention back to the screen.
3		Critical Entries 5.15.8.4 Data Security 5.15.8.13	High	It is possible to shut down the ESL software completely. This might be a problem if the operator inadvertently shuts down while in an emergency situation.
4		Data Entry and Display Consistency 5.15.3.2.1	High	The system uses inconsistent user interface input methods. The ESL system provides GUI, character-based menu, and UNIX interfaces. Main ESL system controls are dispersed among three windows (control menu, TV monitor, and consoles).
5		Data Security 5.15.8.13	High	User can change display color coding and could change emergency color codes. This could lead to errors if other operators use the system.
6	3.13.1.3.4.1 3.13.1.3.4.2 3.13.1.3.4.3	Display Coding Feedback Message 5.15.5.8	High	Compromised systems were represented by changes in color and icon. However, the meaning of the colors is unclear, and software and hardware failures result in presentation of the same icon. When a workstation represented in blue was shut down, the monitoring screen did not indicate the loss of the workstation. (When repeated for a working [green] workstation, the icon did change to red. Warning status shows inconsistent information at the next level. (Sometimes, only red and green status appear and sometimes red and yellow status are displayed)
7	3.13.1.3.4.1 3.13.1.3.4.3	Display Coding 5.4.1.4.5.1 Color Coding 5.2.2.1.18	High	Color coding for system status includes a blue code for emergency services. This color is not generally associated with alarm conditions (not a display stereotype).

Item	SSS	1472D	Priority	Comment
8	3.13.1.2.1.2	Feedback 5.15.2.1.2 Positive Feedback 5.15.1.2 Computer Response	High	Many actions submitted by the user were accepted by the system, but the action did not actually occur. For example, the user initiated a TCW restart, the system accepted and verified the command, but the TCW was not restarted.
9		Feedback Message Content 5.15.5.8	High	During an alarm condition, the user must go to the messages list and read through the TV Monitor list to determine which message is responsible. This list does not aid the user in identifying the source of the alarm.
10		System Status 5.15.1.4 Feedback Message Content 5.15.5.8	High	When a LAN is disconnected from a TCW, the TCW icon turns red, but it is impossible to identify which LAN failed.
11	3.13.1.2.1.2	Computer Response 5.15.1.2 Positive Feedback 5.15.2.1.2	High	No feedback was provided in response to some commands (e.g., when the DCP was restarted). Without feedback, the user may repeat an action that has already been performed.
12		Data Entry	High	When starting the Startup DCP, the user must deselect MCP-1 or it will also restart the workstation in use.
13		Data Entry	High	Magnetic Offset function provides no anchors on the slide bar. There is not a method to directly enter a value.
14		Abbreviations 5.15.3.2.3 Memorization 5.15.4.1.8	Medium	There are too many abbreviations. This requires the user to memorize a lot of information to use the system.
15		Abbreviations 5.15.3.2.3	Medium	Some terminology is not used consistently. Example: TCWs are referred to inconsistently - sometimes they are referred to as OCP. To take a TCW offline (or to put one back online), the user must choose a menu option – “Exit OCP” - from the Control menu window.
16	3.13.1.3.4.1 3.13.1.3.4.3	Flash 5.15.3.3.2	Medium	There is no blinking or flashing. Example: If a critical event arises while the ESL icon is minimized, the icon color changes but does not blink.

Item	SSS	1472D	Priority	Comment
17		Graphic Interaction 5.15.4.1	Medium	The object selection process is too cumbersome and induces errors. Too many steps are required to get status information. To get status information about a particular OCP, the user must first left click on the OCP icon (a right click will display a non-functional pop-up menu), then the user must right click on the icon again to get a pop-up menu from which a status option can be chosen. Error Example: It is possible to select a button with the left mouse button, point to a different button, click with the right mouse button, and get the original button menu. This could be confusing.
18		Display Format	Low	The "select a drive" option can be accessed anywhere within the window, and it is nonfunctional.
19		Log On/Off Procedures	Low	Passwords can be turned off, which means users can change password without knowing the old password. (This option can be disabled.)
20		Log On/Off Procedures	Low	Software that must be accessed by the user is located in separate directories (UNIX level). Releases can be seen by UNIX command.
21	3.13.1.3.5.1	Menu Selection	Low	When services are disabled, buttons in the sub-menus disappear. This may prove to be disorienting for the operator.

Computer-Human Interface Issues for Both Systems

Item	SSS	1472D	Priority	Comment
1	3.13.1.3.4.1 3.13.1.3.4.2 3.13.1.3.4.3	Display Format Consistency 5.15.3.1.1 Criticality 5.15.3.1.2 Data Separation 5.15.3.1.5	High	Display formats are incompatible: • There are at least four interaction styles between the two systems, which requires the user to learn each system independently. Learning four interaction styles could lead to inefficient operations and may result in error, especially when user is performing under high workload conditions. • Both systems allow user to open large amount of windows at once; the user can easily lose the relationship between the open windows. • When multiple windows are opened, they obscure the previously opened windows because they are placed directly over them. • Color coding is inconsistent between the two systems.
2		Format Consistency 5.15.4.2.4	High	There is not a consistent way to switch from the ESL to the FSL system. Currently, user must minimize ESL window to return to FSL system.
3			High	The diagnostic routine was begun and completed, but the user was only provided pass/fail information. The user was unable to view specific test values.
4	3.13.1.2.1.2	Destructive Commands 5.15.4.5.12 Feedback 5.15.5.1	High	When shutting down a TCW, the user is not required to confirm the request.
5		Command Language 5.15.4.5.6 Standardization	High	The user must use a command window (UNIX command-line interface) to perform any diagnostics. The actual diagnostic command is different on each system. The user must type the correct name of the TCW in the command. The TCW names are not the same in both systems.
6	3.13.1.3.4.1 3.13.1.3.4.2 3.13.1.3.4.3	Consistency 5.15.3.1.1	High	Visual and audible alarms are not the same. Color coding, flashing, and audible are in the FSL system, visual (steady color) only in the ESL system.
7		Consistency 5.15.3.1.1	High	The method for changing the subsystem status is inconsistent. For the ESL system, the user goes to the Control menu (a window), chooses “Exit OCP,” then selects TCW/OCP to be taken offline. In the FSL system, the user clicks on the TCW icon and a pop-up menu appears from which the user selects “Reconfigure,” then selects “Off Line.”

Item	SSS	1472D	Priority	Comment
8	3.13.1.4.1.2	Log On/Off Procedures	High	Automatic log off was not observed after a period of inactivity.
9	3.13.1.4.3.2	Data Separation 5.15.3.1.5	High	Too many windows can be open at any one time, and they open on top of each other. This can be very disorienting to a user. It is difficult to determine which windows or applications were open. No parent/child relationship to windows.
10	3.13.1.2.1.4	Command Language	Medium	Many of the functions in both systems require a UNIX command window. UNIX command-line language does not accept upper and lower case as equivalent.
11	3.13.1.4.3.1	Display content 5.15.3.2.1	Medium	When a user resizes views, text wraps in ESL system windows but not in FSL windows.
12	3.13.1.3.1.1	Data Display Standardization 5.5.2.3	Medium	Lack of consistent labels. For example, in the FSL system, labels on working positions change based on assigned airspace (e.g., DR/D6 instead of TCW 1). This requires M&C operators to perform mental operations to identify workstations and may be particularly bothersome when switching from the FSL to ESL system (ESL always uses TCW number).
13	3.13.1.3.1.1	Display Format	Medium	There is no simple way for the user to determine the relationship between items on the MCW displays and the operating positions on the floor. The TCW buttons on the main display are not mapped to floor locations of the workstations, and some of the positions presented don't exist.
14	3.13.1.2.3.1.5 3.13.1.2.3.1.8	Free-Moving XY Controller 5.4.3.2.6, Dynamic Characteristics 5.4.3.2.6.2	Medium	Modification of mouse control parameters is not readily accessible to the user (cursor movement speed, double-click speed, and adaptation to left- or right- handed operators).
15		Information Density 5.15.3.2.2	Medium	System message window displays are dense and difficult to read (e.g., the TV Monitor window).
16		Standardization 5.15.3.2.1	Medium	For the ESL system, there is an indication of an option menu available for data field entry. However, in FSL, option menu fields look exactly the same as manual data entry fields.
17		Display Format	Low	Unable to change time on ESL system. Indicated that time could be done on the ESL system, however, time must be set via a UNIX window, versus a simple procedure for the FSL system.

Item	SSS	1472D	Priority	Comment
18		Display Format	Low	There is no easy way to change the font sizes in the window. The font size in the pull-down menus are too small and are a different size than the pop-up menus available when buttons are selected. Different fonts are used in the different CHI modes.
19	3.13.1.2.3.1.4	Feedback	Low	In both systems, when the cursor was placed over an object for a period of time, feedback was not provided to indicate which object would be selected.
20	3.13.1.2.1.2	Feedback	Low	A user is not notified that they do not have sufficient access privileges to invoke a command until they have entered a new value and attempted to submit it to the system. For example, when the user attempted to modify a library using a UNIX window in the FSL system, it allowed information to be entered and submitted before the user was notified that there was no write permission.
21	3.13.1.2.1.5	Free-Moving XY Controller	Low	Neither system provided the capability for all complete commands to be performed from a single input device. Modifying many of the parameter values required selection and entry using both the keyboard and mouse.
22		Menu Selection	Low	Some menu options needed ellipses (…), which indicate that another window will appear when that option is chosen.
23	3.13.1.3.4.6.6 3.13.1.3.4.6.7 3.13.1.3.4.7 3.13.1.3.4.8	Audio Displays	Low	The frequency, modulation, and duration of auditory alarms was not adaptable.

Section 2
Summaries of EDC Software Issues

Summary of EDC Software Modifications

- Operate with enhanced ARTS keyboard
  - Update DCX resource manager keyboard interface/drivers
  - Update X-server software
  - Update Data Entry Controller firmware
  - Update ESL/EASL key code mapping
  - Provide alternate ESL/EASL functionality for missing key functions
- Operate with ARTS trackball
  - Update DCX resource manager trackball interface/drivers
  - Update X-server software
  - Update Data Entry Controller firmware
  - Update ESL/EASL for single button operation and different slew rate
    - Consolidate SELECT and ENTER functions
    - Provide alternate means of Mark and Hook functions
- Provide “Quick Key” entry in EASL
  - Provide some capability as in ESL plus new EASL functions
  - Highlight (underline) quick key codes when OPS or OFW window is active
- Fix unpredictable trackball ENTER operation
  - Change location of “hot-spot”
  - Correct algorithmic error related to cursor speed setting
- Provide separate display selection switches for all types of radar data
  - Current, History
  - Primary, Beacon, Test Targets
  - Target Extent Symbol
- Delete AF MENU
- Disable window maximize capability (retain normal size)
- Provide function key utilization examples including use of macro codes
  - Range Scale
  - Off-Center
  - Select EASL mode (ARTS)
  - Select ESL mode
  - Open/Close OPS window
  - Open/Close OPS window
  - Set Cursor Home position
  - Home cursor
  - Designate core keyboard
  - Hook
  - Mark
  - Readout
  - Acknowledge
  - Escape
- Allow any range entry from the keyboard
- Separate the Operator Feedback Window (OFW) from the OPS window
  - Permits use of command language (quick keys) when OPS window is closed
- Added “Passive Mode” for AIA/ARTS diagnostic testing
- Updated Quick Reference Card

Summary of Open EDC Software Issues

1. EASL does not always receive audible alarm turn-off commands from ARTS. This causes the alarm at TCW to continue sounding.
   Status: Problem is under investigation.
   Temporary Workaround: Reduce volume to minimum.

2. ARTS Quick Look menu in EASL to emulate five trackball switches is not working.
   Status: Software change to fix problem is ready to be implemented. In the longer term, QL switches on trackball could be implemented.
   Temporary Workaround: Use ARTS keyboard based Quick Look function.

3. ARTS Filter Switches (ALT, SEL, ALL) have been included in menu structure but not implemented.
   Status: Planned for ARTS IIA EDC only.
   Temporary Workaround: Not required for ARTS IIIA.

4. ARTS inputs are ignored when cursor is outside 64 mile range.
   Status: Software solution within EASL is under investigation.
   Temporary Workaround: Keep cursor within ARTS system range while making ARTS data entries.

5. Macro keys are not available when cursor is in the Keyboard Preview window.
   Status: Problem is under investigation.
   Temporary Workaround: Keep cursor out of Preview window, at least while using Macro Keys.

6. The EDC system allows switching the radar site to be used as the source for radar target and weather data. The data is displayed in the correct location relative to the map and data from other radars but the system does not know when ARTS has switched to a different radar. Consequently, ARTS data blocks are displayed with reference to the original radar site and do not align with the radar and map data.
   Status: This is addressed by a PTR in the baseline system. A likely solution involves both software and procedures.
   Temporary Workaround: Utilize only a single radar on EASL. This does not impact ESL.

7. There is an azimuth alignment error in the processing and display of data from the North Turo long range radar.
   Status: This appears to be an adaptation issue that can easily be fixed.
   Temporary Workaround: Do not use the Turo radar to provide radar separation. This data is not processed by ARTS.

EDC Radar Target Symbology

Background:

When operating with the Automated Radar Terminal System (ARTS), the Existing Automation Service Level (EASL) is used to provide the digital presentation of target video data using the Target Extent Symbol. ARTS provides the target symbol for unassociated targets and the control position symbol for associated targets.

In the event of ARTS failure, the display should be switched to Emergency Service Level (ESL). In this service level, the Standard Terminal Automation Replacement System (STARS) provides the same digital representation of target video and adds target symbols along with a two line data block containing code and altitude, replacing the lost ARTS data.

The following settings are recommended to minimize display clutter and still provide all necessary information. Note that EASL and ESL settings are independently maintained and automatically applied when the service level is changed.

Recommended EASL Settings:

It is recommended that the Display Menu settings related to target data in EASL be set as follows:

PRIMARY - ON
BEACON - ON
TGT EXT - ON
HISTORY - User preference, 3 or 4 recommended
All other target and data block settings at the bottom of the Display Menu - OFF

With these settings, the target extent symbol represents the search return or “skin paint” of each target, whether or not they are beacon reinforced. The history data provides an indication of target speed and rate of turn. More detailed characteristics of the target are derived from the ARTS data block and target position symbol. If the primary radar fails to see a target, the target extent symbol will disappear just as the radar video would disappear. However, if it is still seen by the beacon radar, the ARTS track will continue based on beacon data. Otherwise, it will coast.

Note that since ARTS provides all target position symbology and data block information, it is only necessary to enter altimeter setting, block select codes, and altitude filter limits into the ARTS system. Standard ARTS commands are used. Equivalent EASL entries and the system status data window values are not applicable.

Recommended ESL Settings:

It is recommended that the Display Menu settings related to target data in ESL be set as follows:

CURRENT - ON (Turns on the ESL target position symbol)
PRIMARY - ON

BEACON - ON
DATABLK1 - ON (Turns on the 1st line of the ESL data block)
DATABLK2 - ON (Turns on the 2nd line of the ESL data block)
LEADER - ON
TGT EXT - ON
HISTORY - User preference, 3 or 4 recommended

With these settings, data blocks, including target position symbols, will be displayed for all beacon targets and position symbols will be displayed for primary targets. Target extent will be displayed for all targets.

Section 3
Traffic Scenario Configurations

Date	Run	Start Time (EST)	End Time (EST)	Initial Runway Configuration	Scenario Complexity Level	Comments
12/10/97	1	0905 hrs	1038 hrs	Land 27/22L, Depart 22R	1	
12/10/97	2	1059 hrs	1230 hrs	Land 27/22L, Depart 22R	1	
12/10/97	3	1353 hrs	1502 hrs	Land 27/22L, Depart 22R	1	
12/11/97	4	0850 hrs	1005 hrs	Land 4R/L, Depart 9	3	Runway configuration change to 27/22L at 0945 hrs.
12/11/97	5	1039 hrs	1148 hrs	Land 27/22L, Depart 22R	3	Runway configuration change to 4R/L at 1134 hrs.
12/11/97	6	1322 hrs	1428 hrs	Land 4R/L, Depart 9	5	Winds added. Runway 4L closed at 1345 hrs. Runway configuration change to 27/22L at 1417 hrs. Simulated ARTS outage at 1422 hrs; ARTS back online at 1425 hrs.

Section 4
Schedules

Daily Schedule

Day	Activity	Led by
Monday, December 8		
8:00 to 8:30	Introduction & Orientation	Assessment Lead
8:30 to 9:30	Airspace Training	Boston Airspace Trainer
9:30 to 9:45	Break	
9:45 to 10:45	CBI/Lab Training Unit 1	STARS Team
10:45 to 11:15	Break	
11:15 to 12:15	CBI/Lab Training Unit 2	STARS Team
12:15 to 1:30	Lunch	
1:30 to 2:30	CBI/Lab Training Unit 3	STARS Team
2:30 to 3:00	Break	
3:00 to 4:00	CBI/Lab Training Unit 4	STARS Team
Tuesday, December 9		
8:00 to 9:00	CBI/Lab Training Unit 5	STARS Team
9:00 to 9:30	Break	
9:30 to 10:30	CBI/Lab Training Unit 6	STARS Team
10:30 to 11:00	Break	
11:00 to 12:00	CBI/Lab Training Unit 7	STARS Team
12:00 to 1:15	Lunch	
1:15 to 2:15	CBI/Lab Training Unit 8	STARS Team
2:15 to 2:45	Break	
2:45 to 3:45	CBI/Lab Training Unit 9	STARS Team

Day	Activity	Led by
Wednesday, December 10		
8:00 to 8:30	Orientation	Assessment Lead
8:30 to 9:30	Simulation	
9:30 to 10:00	Debrief	
10:00 to 10:30	Break	
10:30 to 11:30	Simulation	
11:30 to 12:00	Debrief	
12:00 to 1:00	Lunch	
1:00 to 2:00	Simulation	
2:00 to 2:30	Debrief	
2:30 to 3:00	Break	
3:00 to 4:00	Final Debrief	
Thursday, December 11		
8:00 to 8:30	Discussion	Assessment Lead
8:30 to 9:30	Simulation	
9:30 to 10:00	Debrief	
10:00 to 10:30	Break	
10:30 to 11:30	Simulation	
11:30 to 12:00	Debrief	
12:00 to 1:00	Lunch	
1:00 to 2:00	Simulation	
2:00 to 2:30	Debrief	
2:30 to 3:00	Break	
3:00 to 4:00	Final Debrief	

Day	Activity	Led by
Friday, December 12		
8:00 to 12:00	Issues Session	
12:00 to 1:00	Lunch	
12:00 to 4:00	Issues Session	

Training
Rotation Schedule

Participant	Day 1 Unit 1	Day 1 Unit 2	Day 1 Unit 3	Day 1 Unit 4	Day 2 Unit 5	Day 2 Unit 6	Day 2 Unit 7	Day 2 Unit 8	Day 2 Unit 9
1	Airspace	CBI	D	CBI	S	CBI	Airspace	CBI	D
2	Airspace	CBI	S	CBI	D	CBI	Airspace	CBI	S
3	CBI	D	CBI	S	CBI	Airspace	CBI	D	CBI
4	CBI	S	CBI	D	CBI	Airspace	CBI	S	CBI
5	D	CBI	CBI	Airspace	CBI	S	D	CBI	CBI
6	S	CBI	CBI	Airspace	CBI	D	S	CBI	CBI
7	CBI	Airspace	F	CBI	R	CBI	CBI	Airspace	F
8	CBI	Airspace	R	CBI	F	CBI	CBI	Airspace	R
9	CBI	F	CBI	R	Airspace	CBI	CBI	F	CBI
10	CBI	R	CBI	F	Airspace	CBI	CBI	R	CBI
11	F	CBI	Airspace	CBI	CBI	R	F	CBI	Airspace
12	R	CBI	Airspace	CBI	CBI	F	R	CBI	Airspace

Note: All controllers will complete nine 1-hour training units during the 2 training days. These units will include four or five using the computer-based instruction (CBI) system, three units using the EDC, and one or two units learning airspace with a Boston controller.

Day Three
Testing Rotation Schedule

Run	Sector[1]	Initial Controller	Relief Controller	Observer Controller	Human Factors
1	D	1	2	3	A
	F	7	8	9	C
	R	10	11	12	D
	S	4	5	6	B
2	D	5	6	4	A
	F	11	12	10	C
	R	8	9	7	D
	S	2	3	1	B
3	D	3	1	2	C
	F	9	7	8	A
	R	12	10	11	B
	S	6	4	5	D

[1] Sector:
D = Initial Departure
F = Final One
R = Rockport
S = South

Day Four
Testing Rotation Schedule

Run	Sector[1]	Initial Controller	Relief Controller	Observer Controller	Human Factors	Major Event	SIMOP Requests[2]					
4	D	4	6	5	C	Runway Reconfiguration	2	3	4	6	6	7
	F	10	12	11	A	Runway Reconfiguration	4					
	R	7	9	8	B	Runway Reconfiguration	1	4	5	6	6	
	S	1	3	2	D	Runway Reconfiguration	1	4	5	6	6	
5	D	3	2	1	B	Runway Reconfiguration	2	3	4	6	6	7
	F	9	8	7	D	Runway Reconfiguration	4					
	R	12	11	10	A	Runway Reconfiguration	1	4	5	6	6	
	S	6	5	4	C	Runway Reconfiguration	1	4	5	6	6	
6	D	5	4	6	D	Switch to ESL	2	3	4	6	6	7
	F	11	10	12	B	Switch to ESL	4					
	R	8	7	9	C	Switch to ESL	1	4	5	6	6	
	S	2	1	3	A	Switch to ESL	1	4	5	6	6	

[1] Sector:
D = Initial Departure
F = Final One
R = Rockport
S = South

[2] SIMOP Requests:
1. SIMOP request for new runway
2. SIMOP request for new callsign
3. SIMOP request for new aircraft type
4. SIMOP request for weather update
5. Point out beyond filter or range
6. VFR popup
7. Incorrect beacon code

Section 5
Airspace Training Package

Boston TRACON - Logan Airport
Standard Terminal Automation Replacement System (STARS)
Early Display Capability (EDC) Assessment
Simulation Training Package

Introduction

The intent of this training package is to provide air traffic controllers with a working knowledge of the selected Boston Terminal Radar Approach Control (TRACON) airspace that will be employed during the Standard Terminal Automation Replacement System (STARS) Early Display Capability (EDC) assessment using the Automated Radar Terminal System (ARTS) IIIA system. The test effort will not be an evaluation of controllers' skills. However, these simulations will be part of an ongoing effort to assess operational suitability issues related to STARS and future air traffic control (ATC) systems.

These simulations have been designed to enable the controller to enter as many inputs into the system as possible. The intent is to provide "real world" situations.

Included in this package are general descriptions of the Boston TRACON sectors/positions, as well as procedures specific to each position that will be used in these simulations.

Simulation Environment

The Target Generation Facility (TGF) is contained in four areas: Target Generator (i.e., a real radar target), Simulation Operation Pilots (SIMOPs), Exercise Control, and Development and Support. The TGF interfaces with the NAS. In short, you will experience a realistic air traffic control environment. Aircraft will respond to your instructions without question. Each time you call a different aircraft it should respond in a like manner.

The basic design of the system, from an air traffic controllers point of view, is simply to provide the user with a system that allows the controller to issue air traffic instructions and have each aircraft perform in a manner similar to a real environment.

TGF

TGF is interfaced with the ARTS IIIA/E systems (Terminal) and the Host Computer System (HCS) and is designed to generate digital radar messages for a simulated airspace environment.

Simulation Pilot

The SIMOPs control the aircraft target during the simulation.

Exercise Control

The Exercise Control controls the execution of the exercise.

Development and Support

The Development and Support area includes the workstations that are used by the scenario developers and analyst to develop scenarios, validate the data base, and preview the scenario. A training specialist from Boston Approach Control has been brought in to review scenarios for accuracy and content.

Support

There is a group of developers that have worked to provide you with the best possible system. There is a constant stream of enhancements that they continue to work on throughout the year. When you leave this facility we hope to have your ideas and suggestions to further improve the system.

Another group that continues to train each day to improve for you are the SIMOPs. They have been trained to understand and respond to proper ATC phraseology; therefore, your clearances should be technically correct in format. Your relationship with the SIMOPs is very important to them and the success of the test effort.

Ghost Positions

All of the airspace included within any facility's area must be accounted for in a given simulation that is conducted here at the Technical Center. This means that every sector must be represented.

There is an additional sector that must be used in the simulation and manned by controllers other than those used to control the test airspace. It is designated as "Ghost Positions." This sector is used to terminate a target aircraft (outbound ghost).

Flights initially entering the facility's airspace will be "started" (start track) in the simulation at a programmed time and in handoff status for the appropriate controller. Flights that are terminated within the facility's airspace will be terminated (drop track) in the outbound ghost sectors airspace.

When a flight is assigned termination frequency **111.1**, the SIMOPs will enter the frequency into the Target Generator computer and the radar track then terminates (drop track) following six (6) additional minutes of flight.

STARS EDC Human Factors Assessment

Boston TRACON will execute a developed scenario utilizing four (4) radar positions. The level of traffic/complexity will be mixed, mostly moderate to heavy. Scenario duration will be approximately 1.5 hours long. The following diagram identifies those positions and their associated frequency.

General Info:

Radar Displays: The following radar displays are used in these scenarios:

Initial Departure (D), South (S), Rockport (R), & Final One (F) Positions

Initial Departure:
a. "D" position, frequency 133.0.
b. This position will utilize the position symbol "D."
c. Combined with Lincoln Sector ("L").
d. All Boston Departures will initiate at this position.
e. All arrivals from "WOONS" will be handed off via interfacility to this position.

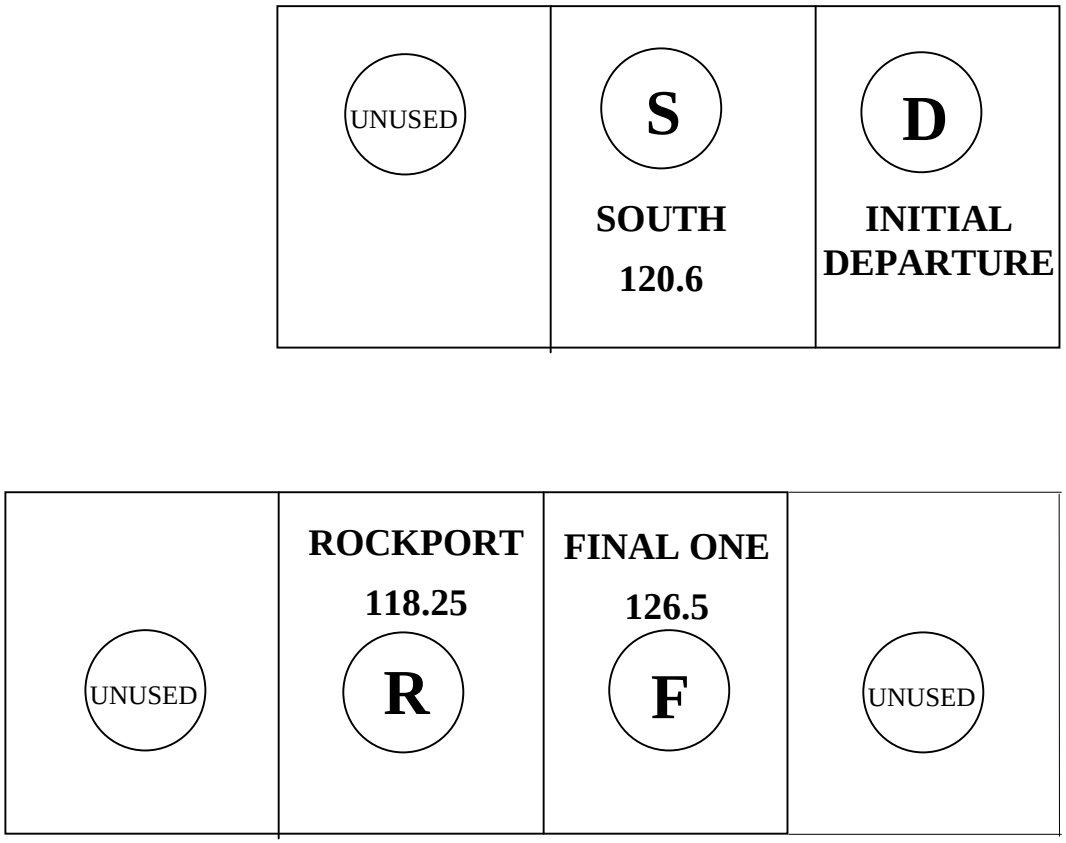
South Sector:
a. "S" position, frequency 120.6.
b. Combined with Plymouth Sector ("M").
c. This position will utilize position symbol "S."
d. This position will accept handoffs from "D" destined to SID departure points of "FRILL," "BURDY," "SEY," "ACK," "HYA," "PVC," "LUCOS," "MVY," and "DRUNK."
e. This position will accept handoffs from interfacility arrival points of "PVC," "FREDO," and "PVD."

Rockport Sector:
a. "R" position, frequency 118.25.
b. This position will utilized the position symbol "R."
c. This position will accept handoffs from "D" destined to SID departure points of "MHT" and "PSM."
d. This position will accept handoffs from interfacility arrival points of "GDM," "KHRIS," "RAYMY," and "SCUPP."

Final One:
a. "F" position, frequency 126.5.
b. This position will utilize a position symbol "F."
c. This position will accept only intrafacility handoffs.

LABORATORY LAYOUT

ARTS 3E DISPLAYS



ARTS 2A DISPLAYS

DOOR

INITIAL DEPARTURE ("D")

In these scenarios, this position is also combined with the Lincoln sector. Lincoln sector is predominantly a westbound departure corridor and an inbound sector for arrivals flight planned over "WOONS."

FREQUENCY INFORMATION

Primary frequency for this position will be 133.0.

DEPARTURE PROCEDURES

Initial Departure is the outlet for all aircraft departing the Logan International Airport. Aircraft are vectored per a radar Standard Instrument Departure (Logan-Nine SID) procedure, which outlines departure instructions and noise abatement procedures as follows:

ALL Jet Aircraft

Runway 22R or 22L: Fly heading 140 degrees, climb and maintain 5,000'.
Runway 9: Fly runway heading, climb and maintain 5,000'.
Runway 4R: Fly runway heading until the BOS 4 DME, then turn right heading 090 degrees, climb and maintain 5,000'.

ALL Prop Aircraft

Fly assigned heading, climb and maintain 3,000'.

ARRIVAL PROCEDURES

Since the configuration of Initial Departure combines the functions of "Lincoln Sector," the following arrivals will require service.

Route	***Altitude***
WOONS BOS	7,000'

CONTROLLER ACTIONS

1. All arrival aircraft will be handed off to the Final One ("F") position for sequencing and approach clearances.

SOUTH/PLYMOUTH ("S")

In these scenarios, this position is also combined with the Plymouth Sector. Plymouth Sector is predominantly a southbound departure corridor and an inbound sector for arrivals flight planned over "PVD," "FREDO," and "PVC."

FREQUENCY INFORMATION

Primary frequency for this position will be 120.6.

DEPARTURE PROCEDURES

Departures are handed-off from Initial Departure to this sector for jet/prop traffic departing southbound.

To Boston Center:
Jet departures and are vectored outbound on a heading of 170-210 degrees.
Jet departures routed over ACK (Nantucket), will be issued "direct ACK."
Props requesting at or above 12,000' are issued "maintain 12,000'" and vectored on a heading of 170-210 degrees.

To Providence Approach:
Props requesting at or below 10,000' shall be vectored to join V268 North of INNDY.

To Cape Approach:
Props landing HYA, MVY, ACK are sent via "direct" at 5,000', 7000', or 9,000'.
Props landing PVC are sent via "direct" at 3,000'.

ARRIVAL PROCEDURES

The following arrivals will require service by this sector/position landing Boston.

Runway	***Route***	***Altitude/Restriction(s)***
4R	PVD.V141.INNDY.BOS	cross PVD at 11,000', at 250 knots
27	PVD.V141.INNDY.BOS	cross PVD at 11,000', no speed restriction
27	FREDO.BOS	6,000'
27	PVC.BOS	4,000'

CONTROLLER ACTIONS

1. Aircraft may be vectored to either 4R or 4L, as determined by controller personnel, for a more efficient use of airspace/runway utilization.

2. All arrival aircraft will be handed off to the Final One ("F") position for sequencing and approach clearances.

ROCKPORT SECTOR ("R")

Rockport Sector is predominantly a north/northeast bound departure corridor and an inbound sector for arrivals flight planned over "GDM," "RAYMY," "KHRIS," and "SCUPP."

FREQUENCY INFORMATION

Primary frequency for this position will be 118.25.

DEPARTURE PROCEDURES

Departures are handed-off from Initial Departure to this sector for jet/prop traffic departing north/northeast bound.

To Boston Center:
Jet departures and are vectored outbound "direct MHT" or "direct PSM," as appropriate.
Prop departures and are vectored outbound "direct MHT" or "direct PSM," as appropriate.
Props requesting at or above 12,000' are issued "maintain 12, 000 ft" and vectored "direct MHT" or "direct "PSM," as appropriate.

To Manchester Approach:
Prop departures to Boston Center (at or above 12,000') may be issued "maintain 10,000'" and handed-off to Manchester Approach. Five (5) mile longitudinal separation shall be provided to these successive operations.

All other aircraft will be issued "direct MHT" and climbed to 10,000' or lower, as requested.

ARRIVAL PROCEDURES

The following arrivals will require service by this sector/position landing Boston.

Runway	***Route***	***Altitude/Restriction(s)***
all	RAYMY.LWM.BOS	6,000' (props)
all	KHRIS.LWM.BOS	5,000' (props)
all	GDM.V431.REVER.BOS	cross BRONC (props) 9,000'
all	GDM.V431.REVER.BOS	cross BRONC (jets) 11,000', at 250 knots
27	SCUPP.BOS	jets 11,000', at 230 knots
4R	SCUPP.BOS	jets 11,000', at 250 knots
all	SCUPP.BOS	props 10,000'

CONTROLLER ACTIONS

1. Aircraft may be vectored to either 4R or 4L, as determined by controller personnel, for a more efficient use of airspace/runway utilization.

2. Aircraft may be vectored to either 22L or 27, as determined by controller personnel, for a more efficient use of airspace/runway utilization. In either case, ensure aircraft assigned runway 22L by controllers are capable of the hold short operation (simultaneously landing runway 27).

3. All arrival aircraft will be handed off to the Final One ("F") position for sequencing and approach clearances.

FINAL ONE ("F")

In these scenarios, this position is also combined with the Final Two (I) position. Final One is the final approach control position where all approach clearances are issued for Logan International Airport and aircraft subsequently transferred to the Tower Local Control for landing clearances. This position does not typically control departure traffic, though coordination for such operations may be requested.

FREQUENCY INFORMATION

Primary frequency for this position will be 126.5.

ARRIVAL PROCEDURES

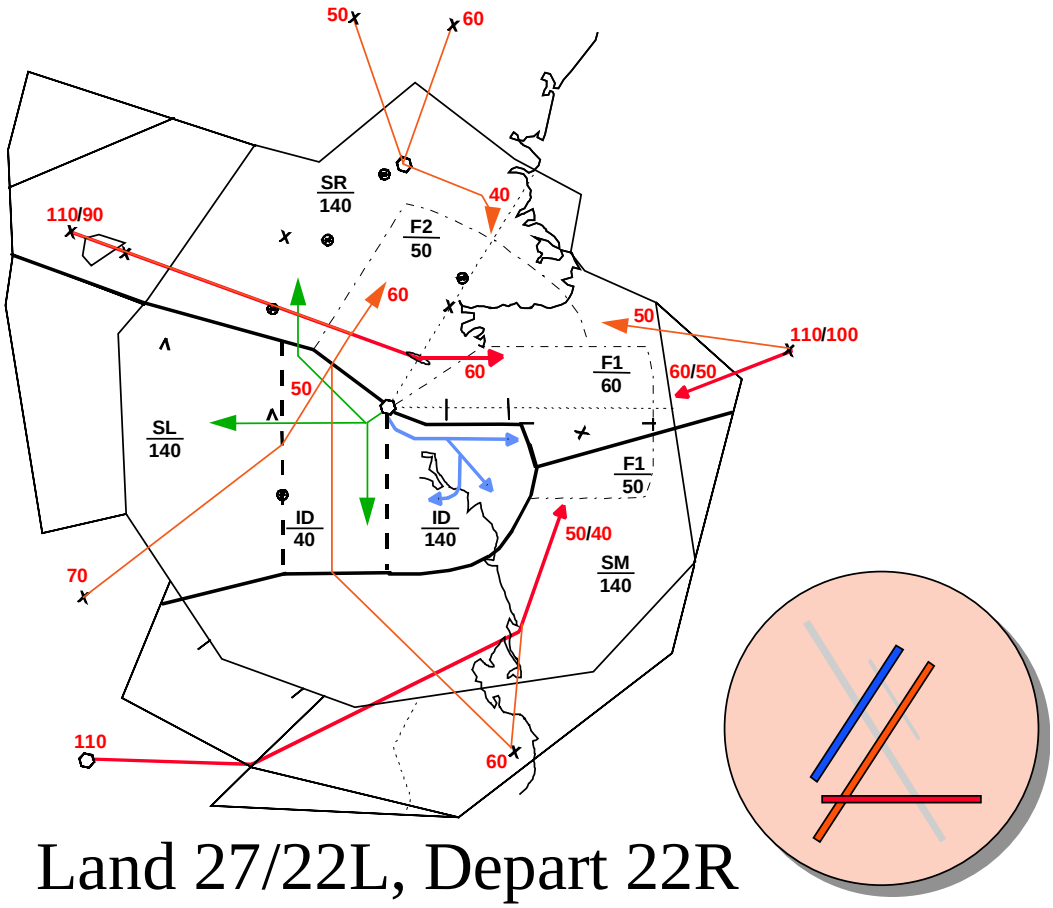
The following arrivals will require service by this sector/position landing Boston.

Runway	***Aircraft Type***	***Transferred by***	***Altitude/Route***
4R	jets	Rockport Sector	6,000'/on a right downwind
4R	jets	South/Plymouth Sector	6,000'/established on the extended use 4R localizer
4L	props	Rockport Sector	5,000'/on a left downwind
4L	props	Init. Departure from WOONS	4,000'/direct BOS VOR
27/22L	jets/props	Rockport Sector from GDM	6,000'/on a right downwind
27	jets	Rockport Sector from SCUPP	6,000'/vector to join the runway 27 localizer
27	props	Rockport Sector from SCUPP	5,000'/vector to join the runway 27 localizer
27	jets	South/Plymouth	5,000'/left base leg vector at TONNI
27	props	South/Plymouth	4,000'/left base leg vector at TONNI
22L	props	Rockport Sector from RAYMY	4,000'/right base leg from LWM VOR
22L	props	Rockport Sector from KHRIS	4,000'/right base leg from LWM VOR
22L	props	Init. Departure from WOONS	5,000'/right downwind

CONTROLLER ACTIONS

1. Aircraft may be vectored to either 4R or 4L, as determined by controller personnel, for a more efficient use of airspace/runway utilization. Aircraft inbound for runway 4L should be vectored for the visual approach to an imaginary final. SIMOP personnel will make all descents and necessary turns after the issuance of the visual approach. Runway 4R, 22L, and 27 arrivals shall be vectored for that published runway's ILS approach.

Primary runway arrivals (runway 4R or 27, depending on configuration) shall remain on the position symbol "F." Secondary arrivals (runway 4L or 22L) data tags shall be changed (local ARTS patch) to a position symbol of "X." This identifies the runway assignment and reduces confusion by Approach/Tower personnel.



Land 27/22L, Depart 22R

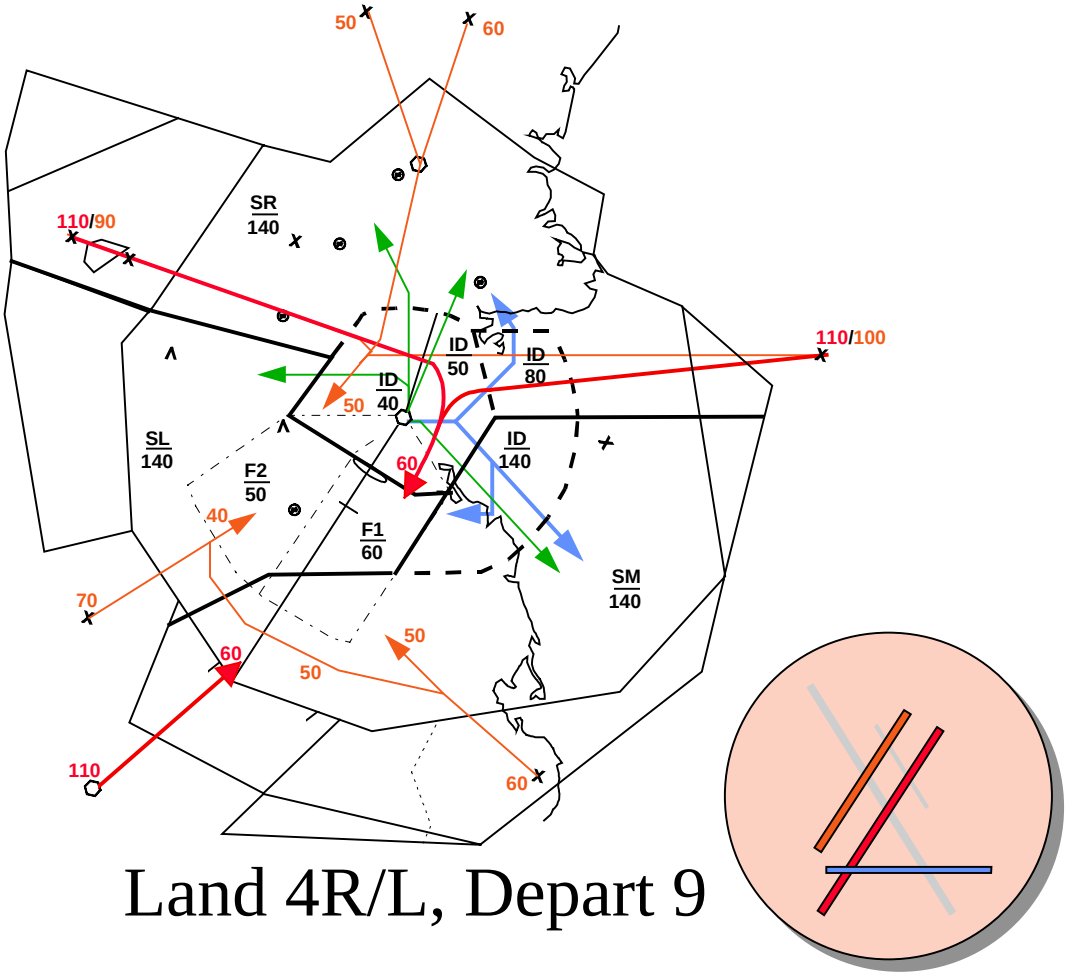
A look at the overall flow of traffic for this configuration.

Color Key

Red = JET Arrival Flow (thick line)
Blue = JET Departure Flow (thick line)

Orange = PROP Arrival Flow (thin line)

Green = PROP Departure Flow (thin line)



Land 4R/L, Depart 9

A look at the overall flow of traffic for this configuration.

Color Key

Red = JET Arrival Flow (thick line)
Blue = JET Departure Flow (thick line)

Orange = PROP Arrival Flow (thin line)

Green = PROP Departure Flow (thin line)

Section 6
Early Display Capability Functions

ARTS Data Block Functions

1. Enter Scratch Pad Data (Active or Prepared) in “Y” Area
2. Active Track Implied Scratch Pad Entry/Change in “Y” Area
3. Display/Amend Aircraft Type in Scratch Pad (“H” Area)
4. Delete Scratch Pad Data (Active or Proposed) in “Y” Area
5. Display/Amend/Delete Heavy Jet Indicator/Flight Plan Status Indicator
6. Display/Amend/Delete TCAS Indicator
7. Implied Select/Erase FDB Readout
8. Beacon/Speed/Altitude Readout for Unassociated Track
9. Modify LDB Filter Limits for Unassociated/Associated Tracks
10. Display Selected Filter Limits for LDBs
11. Implied Inhibit Blinking DM
12. Reposition Tag
13. Automatic Offset Select/Inhibit
14. Move Leader Direction on all FDBs
15. Move Leader Direction on Single FDB

ARTS Flight Data Functions

16. Implied Handoff Accept
17. Implied Handoff Initiate or Re-direct
18. Implied Handoff to ARTS Site
19. Take Back Flashing “IF”
20. Activate an Existing Track File from CST or TAB List
21. ARTS Force
22. Quick Look
23. Quick Look all Open ARTS Positions
24. Deselect (Clear) all Quick Look Selections
25. Implied Inhibit/Display Quick Look Single Position
26. Suspend Active/TAB/Stored Track
27. Restart a Suspended Track
28. Terminate Track
29. Drop VFR from VFR List
30. Modify Track File Data to Another Control Position
31. Change System Area
32. Display Flight Data on a Specified Aircraft
33. Implied Flight Data Entry
34. Put VFR in NAS (With Optional Departure Point and Altitude)
35. Modify Track File Data (Aircraft Callsign)
36. Modify Track’s Assigned Beacon Code to an IFR or VFR Code
37. Modify an Aircraft Data File from one CID to Another
38. Change Atmospheric Pressure

ARTS Miscellaneous Functions

39. Implied Airport Readout or Range/Bearing
40. Configure ARTS position or Deconsolidation “DCON”
41. Consolidate Positions (Stored Tracks & Flight Plans, Present and Future)
42. Full Consolidation – All Tracks “FCON”
43. Combine Two Sectors
44. Decombine Two Sectors

Radar Display Configuration Functions

45. Move Preview Area
46. Move TAB List
47. Move LA/CA Area
48. Move Coast/Suspend List
49. Move VFR List
50. Move Systems Area
51. Move Sign on Display
52. Inhibit/Display TAB List
53. Inhibit/Display LA/CA Area
54. Inhibit/Display VFR List
55. Inhibit/Display Coast/Suspend List
56. View the MVA Map
57. Change the Position of Windows
58. Change the Size of Windows
59. Turn a Full-Size Window into an Icon
60. Turn an Icon into a Full-size Window
61. Change Scope Range
62. Change Scope Center
63. Change Font Size
64. Change Brightness of Targets
65. Change Brightness of Weather
66. Change Brightness of Maps
67. Change Brightness of Range Rings
68. Change Brightness of Compass Rose
69. Change Brightness of ARTS Tracks
70. Change Brightness of Tabular Lists
71. Change Cursor Speed
72. Change Beacon Code Filter Properties
73. Change Altitude Filter Properties
74. Change Leader Lengths
75. Change Range Ring Properties
76. Change Number of Histories
77. Change Audible Alarm Volumes
78. Toggle all Weather
79. Toggle Specific Weather Levels
80. Toggle Altitude Filters

81. Toggle Range Rings
82. Toggle Target Extent Symbols
83. Toggle Compass Rose
84. Toggle Sites
85. Toggle Current Reported Plot Data
86. Toggle Current Reported SR Data
87. Toggle History Trails
88. Toggle Test Target Symbols
89. Toggle Top Line of Data Block
90. Toggle Bottom Line of Data Block
91. Toggle Leader Lines

Section 7
Simulation Events

1. Switch to Emergency Service Level (ESL)
2. Runway Reconfiguration
3. SIMOP Request for New Runway
4. SIMOP Request for New Callsign
5. SIMOP Request for Missed Approach
6. SIMOP Request for New Destination
7. SIMOP Request for New Aircraft Type
8. SIMOP Request for Weather Update
9. Point Out Beyond Filter or Range
10. Deviate off Localizer
11. Engine Failure
12. VFR Popup
13. Incorrect Beacon Code

Section 8
Macro Key Reference Card

STARS EDC MACRO KEY REFERENCE CARD

CON	MAP	M1	M2	M3	M4	M5	M6	M7	M8
TRK	USR	M9	M10	M11	M12	M13	M14	M15	M16

KEY	LABEL	FUNCTION
M1	ACK	Acknowledge
M2	SET	Set Home
M3	OPS	Open/Close
M4	TABS	Open/Close
M5	ESL	Select ESL
M6	EASL	Select EASL
M7	KBD	Select KBD
M8	HOME	Move Cursor
M9	HOOK	Hook Object
M10	MARK	Mark Point
M11	RO	Read Out
M12	ESC	Escape
M13		Spare
M14		Spare
M15	RNG	Range *
M16	OC	Offset/Center

* Range value may be entered as any value between 6 and 256. Leading zeros are permitted but not required. If entry is less than 3 digits, complete with ENTER.

Note: To use Macro keys, focus may be anywhere except in the KBD PREV AREA.

Section 9
Quick Key Reference Card

STARS EDC QUICK KEY REFERENCE CARD

OPS WINDOW

AT	AT MENU
DI	DISPLAY
MA	MAPS

AT MENU (ADEs)

AL	ALTIMETER
AC	ACKNOWLEDGE
RG	RANGE
OC	OFF-CENTER
FZ	FONT SIZE
BT	BRITE
CS	CURSOR SPEED
BS	BLOCK SELECT
FI	ALT FILTER
RR	RANGE RINGS
HS	HISTORY
SS	SITE SELECT
DR	DROP
QL	ARTS QL
FL	ARTS FIL
LL	ARTS LLEN
LD	ARTS LDIR
VL	ARTS VOL

DISPLAY MENU

(ON/OFF TOGGLES)

WA	WX ALL
W1	WX LEVEL 1
W2	WX LEVEL 2
W3	WX LEVEL 3
W4	WX LEVEL 4
W5	WX LEVEL 5
W6	WX LEVEL 6
AL	ALT FILTER
RN	RANGE RINGS
CP	COMPASS ROSE
ST	SITES
CU	CURRENT
HI	HISTORY
PR	PRIMARY
BE	BEACON
TG	TEST TARGETS
B1	DATA BLK LINE 1
B2	DATA BLK LINE 2
LE	LEADER
TX	TARGET EXTENT

Note: OPS window does not have to be displayed to use Quick Keys, however, focus must be in the OFW or OPS window. In ESL, focus is not required.

Section 10
Controller Responses to Controller Questionnaire

Item	T or Y Responses	F or N Responses	N/O* Responses
I. Visual Displays			
A. General			
1. Display clutter is not a problem (7.2.20).	0	12	0
2. The meaning of each icon is immediately apparent to the controller or it is labeled (7.2.1).	1	10	0
2a. The locations of the icons are predictable.	2	9	0
3. Information that the controller needs does not disappear from the screen without being deleted or suppressed by the controller.	2	9	0
4. The computer responds quickly so that the controller is not kept waiting for information.	1	11	0
5. Terms (such as commands) used in EDC have the same meaning in ESL.	5	3	2
6. Essential ATC information is never blocked or obstructed by other information (7.2.17).	0	12	0
7. Visual displays provide whatever information is needed (5.3.2, 7.2).	1	10	0
8. Target symbols are easy to read and identify (7.2.9, 5.1.5).	0	12	0
9. The meaning of each symbol is immediately apparent (7.2.1).	0	12	0
10. Symbols in EDC have the same meanings as in ARTS (7.2.3).	0	10	0
11. Symbol size can be adequately adjusted by the controller (7.2.10).	2	10	0
12. EDC operational procedures and display designs accommodate current separation requirements within current levels of safety.	1	11	0
B. Visual Alerts			
1. The alerts are easy to see and understand.	6	6	0
II. Cognitive Workload			
A. General			
1. It is easy to detect errors in data entry.	0	12	0
2. It is easy to correct errors in data entry.	1	11	0
B. Automation			
1. After system recovery from degradation or failure, a smooth return to EDC will be possible (6.2.1).	1	10	1

* No Opportunity

Item	T or Y Responses	F or N Responses	N/O Responses
III. Data Entry Procedures			
A. General			
1. EDC display/control and data entry capabilities minimize any increase in controller visual attention to display locations that will interfere with attention to high priority tasks.	0	12	0
2. The data entry method helps to minimize errors and provides for quick, simple data editing and correction (7.5.3).	0	12	0
3. The number of keystrokes (or other control actions) necessary to input data is kept to a minimum.	0	12	0
4. The amount and complexity of data entry is about the same as what the controllers are used to (6.2.2).	0	12	0
5. The location of the cursor is predictable (7.5.3). (If "false," please describe any situations in which it was not predictable.)	2	9	0
B. Commands and Command Execution			
1. Command execution requires minimal controller action (7.5.2).	0	12	0
2. The status information in ESL is adequate (7.5.2).	5	7	0
3. The status information in EDC is adequate (7.5.2).	3	9	0
C. Menus			
1. The menus are easy to use (7.2.18).	1	11	0
2. The menu options are easy to understand (7.2.18).	0	12	0
3. It is easy to know where to find each menu (7.2.18).	2	9	0
4. Menu options are arranged in a logical order with the most frequently performed functions at the top.	0	11	0
D. Error Messages and User Guidance			
1. Error messages are clear and easy to understand (7.5.5, 7.5.6).	1	11	0
2. Each error message briefly summarizes the specific problem and proposes a specific solution (7.5.5, 7.5.6).	1	10	1
3. There were times when I did not know what the system was doing. (If True, please describe the situation that was confusing.)	9	2	0
IV. Data Entry and Control Devices			
A. General			
1. The input device(s) is/are appropriate for performing the necessary functions (e.g., alphanumeric data entry, use of windows, cursor positioning).	3	8	0

Item	T or Y Responses	F or N Responses	N/O Responses
B. Keyboards			
1. Function keys are provided for frequently used commands (7.4.3).	3	7	0
2. The functions invoked by the function keys are consistent from EDC to ESL (7.4.3).	6	3	1
C. Trackballs			
1. The trackball can move the cursor in any direction without causing cursor movement in the opposite direction (7.4.3).	7	5	0
2. The trackball allows the controller to move the cursor quickly across relatively large distances.	9	2	0
3. The trackball allows the controller to precisely position the cursor within a small area (7.4.3).	5	6	0
4. It is easy to use the trackball to open a menu (7.4.3).	4	8	0
5. It is easy to use the trackball to select a menu item (7.4.3).	4	8	0

Section 11
Human Factors Specialist Responses to Controller Questionnaire

Item	T or Y Responses	F or N Responses	N/O* Responses
I. Visual Displays			
A. General			
1. Display clutter is not a problem (7.2.20).	0	3	0
2. The meaning of each icon is immediately apparent to the controller or it is labeled (7.2.1).	0	4	0
2a. The locations of the icons are predictable.	2	1	1
3. Information that the controller needs does not disappear from the screen without being deleted or suppressed by the controller.	2	1	1
4. The computer responds quickly so that the controller is not kept waiting for information.	1	3	0
5. Terms (such as commands) used in EDC have the same meaning in ESL.	1	2	1
6. Essential ATC information is never blocked or obstructed by other information (7.2.17).	0	4	0
7. Visual displays provide whatever information is needed (5.3.2, 7.2).	2	2	0
8. Target symbols are easy to read and identify (7.2.9, 5.1.5).	0	4	0
9. The meaning of each symbol is immediately apparent (7.2.1).	0	4	0
10. Symbols in EDC have the same meanings as in ARTS (7.2.3).	1	2	1
11. Symbol size can be adequately adjusted by the controller (7.2.10).	2	2	0
12. EDC operational procedures and display designs accommodate current separation requirements within current levels of safety.	0	4	0
B. Visual Alerts			
1. The alerts are easy to see and understand.	3	1	0
II. Cognitive Workload			
A. General			
1. It is easy to detect errors in data entry.	0	4	0
2. It is easy to correct errors in data entry.	0	4	0
B. Automation			
1. After system recovery from degradation or failure, a smooth return to EDC will be possible (6.2.1).	1	2	1

* No Opportunity

Item	T or Y Responses	F or N Responses	N/O Responses
III. Data Entry Procedures			
A. General			
1. EDC display/control and data entry capabilities minimize any increase in controller visual attention to display locations that will interfere with attention to high priority tasks.	0	4	0
2. The data entry method helps to minimize errors and provides for quick, simple data editing and correction (7.5.3).	0	4	0
3. The number of keystrokes (or other control actions) necessary to input data is kept to a minimum.	0	4	0
4. The amount and complexity of data entry is about the same as what the controllers are used to (6.2.2).	0	4	0
5. The location of the cursor is predictable (7.5.3). (If "false," please describe any situations in which it was not predictable.)	0	4	0
B. Commands and Command Execution			
1. Command execution requires minimal controller action (7.5.2).	0	4	0
2. The status information in ESL is adequate (7.5.2).	0	3	1
3. The status information in EDC is adequate (7.5.2).	1	3	0
C. Menus			
1. The menus are easy to use (7.2.18).	0	4	0
2. The menu options are easy to understand (7.2.18).	2	2	0
3. It is easy to know where to find each menu (7.2.18).	1	3	0
4. Menu options are arranged in a logical order with the most frequently performed functions at the top.	0	1	3
D. Error Messages and User Guidance			
1. Error messages are clear and easy to understand (7.5.5, 7.5.6).	0	2	2
2. Each error message briefly summarizes the specific problem and proposes a specific solution (7.5.5, 7.5.6).	0	2	2
3. There were times when I did not know what the system was doing. (If True, please describe the situation that was confusing.)	1	0	3

Item	T or Y Responses	F or N Responses	N/O Responses
IV. Data Entry and Control Devices			
A. General			
1. The input device(s) is/are appropriate for performing the necessary functions (e.g., alphanumeric data entry; use of windows, cursor positioning).	3	1	0
B. Keyboards			
1. Function keys are provided for frequently used commands (7.4.3).	2	1	1
2. The functions invoked by the function keys are consistent from EDC to ESL (7.4.3).	0	1	3
C. Trackballs			
1. The trackball can move the cursor in any direction without causing cursor movement in the opposite direction (7.4.3).	4	0	0
2. The trackball allows the controller to move the cursor quickly across relatively large distances.	3	0	1
3. The trackball allows the controller to precisely position the cursor within a small area (7.4.3).	2	1	1
4. It is easy to use the trackball to open a menu (7.4.3).	4	0	0
5. It is easy to use the trackball to select a menu item (7.4.3).	3	1	0

Section 12
Human Factors Specialist Questionnaire Responses

Item	T or Y Responses	F or N Responses	N/O* Responses
I. Visual Displays			
A. General			
1. Visual displays maintain good image quality even at the dimmest possible setting (7.2.8)..	2	1	1
2. Standard data fields are consistent from EDC to ESL (7.2.18).	1	2	0
3. Only one abbreviation is used for each word or item and abbreviations are used consistently within ESL and EDC (7.2.15).	1	2	1
4. Terms and symbols used in EDC have the same meaning in ESL.	1	2	1
B. Visual Alerts			
1. If blinking is used, it is cancelable by the controller (7.2.11).	1	2	1
2. Information that is blinking, has an "on" period that is at least as long as the "off" period (5.1.5).	1	0	2
3. If blinking is used, the blink rate is between 2 and 3 Hz (5.1.5, 7.2.11).	1	0	3
II. Data Entry Procedures			
A. General			
1. Keystrokes or other data entry actions are echoed immediately on the screen, that is, there is no delay in providing a legible representation of what has been entered.	2	2	0
2. The controller receives appropriate feedback on data acceptance or rejection (7.5.3).	0	3	1
3. Boundaries indicate where to enter the data and show maximum field length (7.2.17).	2	2	0
4. A cursor appears to indicate data-entry mode and location (7.5.3)	1	2	1
5. The controller can edit all or part of a data field (7.5.3).	2	2	0
6. The controller is not required to enter leading zeroes for numeric entries (7.5.3).	2	0	2
6a. If leading zeros are required (e.g., for altitude filter limits) is this something the controller is used to?	0	0	3
7. Field labels use accepted ATC terminology and are used consistently (7.5.4).	1	2	1

* No Opportunity

Item	T or Y Responses	F or N Responses	N/O Responses
B. Commands and Command Execution			
1. The controller can suspend/interrupt or cancel/undo a transaction in progress (7.5.3).	2	2	0
2. The relevant command set is displayed to show the controller which commands are currently available (7.5.2).	0	4	0
3. The computer indicates the current operational mode (7.5.2).	2	2	0
4. Upper and lower case letters are accepted as equivalent when the controller is entering a command or command parameter.	0	0	3
5. Feedback is always given to indicate that the computer has initiated a command (7.5.2).	0	3	1
6. Command execution is consistent between EDC and ESL.	0	2	2
C. Menus			
1. Options that perform opposing actions are not placed adjacent to each other (7.2.18).	1	0	3
2. The number of menu options is between three and ten (five to six options is optimal) (7.2.18).	0	3	1
3. If an option, or set of options, is never available to the user, the option(s) is not in the menu (7.2.18).	0	3	1
4. If an option is temporarily unavailable, it is displayed in the menu, but dimmed (7.2.18).	0	1	3
5. Less frequently executed options and destructive commands are at the bottom of the menu.	0	2	2
6. If similar options are in different menus, the options are ordered in a consistent manner (7.2.18).	0	2	2
7. Each word in the menu is presented in upper and lower case with the first letter capitalized (7.2.18).	0	4	0
8. When a menu is displayed, the location cursor is in the first available option (7.2.18).	0	4	0
9. When a menu is displayed, the location cursor is in the first available option (7.2.18).	0	1	0
10. The menus in EDC are the same as in ESL.	1	2	1
11. Did the controllers have access to the AF menu?	0	4	0
11a. If yes, did this add frustration or workload?	0	0	0
D. Error Messages & User Guidance			
1. Error messages are presented immediately after an error's occurrence (7.5.7).	2	1	1

Item	T or Y Responses	F or N Responses	N/O Responses
2. Error messages are not redundant (7.5.6).	0	0	4
3. Guidance messages are presented in mixed upper and lower case (7.5.7).	0	2	1
4. Messages about limits not met or exceeded specify the appropriate range for data entry (7.5.8).	0	2	2
5. Questionable data entries elicit cautionary messages (7.5.8).	0	3	1
6. Feedback regarding processing delays specifies the process, the length of the delay, and completion of the process (7.5.8).	0	3	1
III. Data Entry and Control Devices			
A. Keyboards			
1. Keyboards are readable under all operating conditions and backlit, if necessary (7.4.3).	2	1	1
2. Keyed data are displayed quickly (echoed) on the screen (7.4.3).	1	2	1
3. Tactile and auditory feedback are provided in response to keystrokes (7.4.3).	1	1	1
4. The functions invoked by function keys are consistent from EDC to ESL.	0	2	2
B. Trackballs			
1. The trackball can move the cursor in any direction without causing cursor movement in the opposite direction (7.4.3).	3	0	1

Section 13
STARS Research and Application Candidate Operations and Maintenance Issues

Candidate AT and Maintenance Issues	Transition	Major	Minor	Proposed
FUNCTIONALITY CHANGES				
Occluded Functions: The impact on performance attributed to EDC functions that will not be available during ISC/FSC. These functions were previously available at specific site locations, provided by local patches, or resident only in STARS transition states or prototype versions of upgrades.	X	X		
Added Functions: The impact on performance attributed to additional capabilities and functions provided during the specific transition, upgrade, or enhancement	X	X	X	X
TRAINING & STAFFING				
Training Efficacy: The performance achieved as a result of having completed the training package for STARS	X	X	X	X
Training Materials: Quality of training materials and their suitability to the user's task and environment	X	X	X	X
Personnel Selection and Staffing: Impact on the number, attributes, and abilities of personnel selected and staffed for the operator and maintainer positions	X	X		
USER DOCUMENTATION				
System Documentation: Quality of system documentation (for logistics support, user operational aids, configuration management, maintenance) and its impact on life-cycle human-system performance measures	X	X	X	X
SYSTEM/EQUIPMENT CONFIGURATION				
System Stability: Impact on performance of the STARS design as it undergoes hardware and software modifications (those known and others not yet fully delineated or assessed)	X	X		
Tower Displays: Comprehensive human factors assessment of STARS and its transition versions for tower applications	X	X	X	

Candidate AT and Maintenance Issues	Transition	Major	Minor	Proposed
HUMAN COMPUTER INTERFACE & DISPLAY CHARACTERISTICS				
Display Characteristics and Features: Attributes affecting human performance of the display including organization, symbology, contracts, menuing, graphics, symbol size, fonts, contrast, and the like	X	X	X	X
Color Palette: Determination of the appropriate color palette is being conducted under a separate study due to provide preliminary findings in February 1988.	X	X	X	X
Use of Color: Plans for the use of the color palette, which has yet to be fully defined	X	X	X	X
Operational Procedures: This is a comprehensive human factors assessment of STARS procedures, especially as they differ from those in EDC and the transition versions. For example, the ambiguity and potential impact on controller performance with respect to any changes in the standards applied to separation.	X	X	X	X
Function Keys Allocation: Compatibility of function key allocations with other system/subsystems integrating with STARS transition states and FSL	X	X	X	X
Keyboard Type and Configuration: Unknowns about the optimal long-term keyboard type (e.g., QWERTY, ABC) and configuration (placement of special keys and functions)	X	X		
Alarms and Alerts: How all alarms and alerts are integrated to ensure the proper level of operator awareness and resolution	X	X	X	X
Inconsistency of CHI: Consistency in the way CHI is applied in each and across developing systems/subsystems	X	X	X	X
Command Changes: Unknown impact on performance of the difference between commands used in EDC and those for future STARS states	X	X	X	X

WORK SPACE DESIGN, ANTHROPOMETRICS & ENVIRONMENT				
Work Space Design: The functional design of the operator's and maintainer's work space to provide for ease of use of all equipment and proper working relationship with other members of the team	X	X	X	
Anthropometrics: Ability of the design to accommodate physical differences among individuals of the user population	X	X		
Environment: The design of the equipment and its surrounding facility for parameters related to illumination, sound, and air quality to enhance performance	X	X	X	
HEALTH, SAFETY, & SECURITY				
Health: Considerations of equipment design and procedure on potential health such exposure to battery emissions, eyestrain or damage, or repetitive motion injuries	X	X		
Safety: Designs and precautions that prevent injury due to exposure to such safety hazards as electrical shock, heavy lifting, or sharp edges	X			
Security: The impact on human performance of security precautions that preclude inadvertent intrusion to the system or that prevent intentional intrusion	X			

Section 14
STARS Research and Application Areas Estimated Level of Effort

Transitions and Enhancements	Metrics/ Baselines	CHI Prototypes	HITL Simulation	Task & Workload Analysis	Work-station Integration	Trade-Off Analyses	Program Documentation
ISC TRANSITION: Enhancements that reflect the implementation state changes in the initial STARS capability (including the qwerty keyboard and mouse, AIG, and ETMS)	H	H	H	H	H	H	H
FSC TRANSITION: Enhancements that reflect the implementation state changes in the final STARS capability (including FMA, CRDA, and CASA)	H	H	H	H	H	H	H
MAJOR: Additional enhancements that have a substantial impact upon the ARTS or STARS platforms							
Center TRACON Automation System/Final Approach Spacing Tool (CTAS/FAST)	H	H	H	H	H	M	M
All Purpose Structured Eurocontrol Radar Information Exchange (ASTERIX)	M	M	M	L	L	L	L
Automated Barometric Pressure Entry (ABPE)	L	L	L	L	L	L	L
Terminal Data Link (TDL)	H	H	H	H	M	M	M

Transitions and Enhancements	Metrics/ Baselines	CHI Prototypes	HITL Simulation	Task & Workload Analysis	Work-station Integration	Trade-Off Analyses	Program Documentation
Selective Interrogation	L	L	L	L	L	M	L
MINOR: Enhancements that have a relatively minor impact upon the ARTS or STARS platforms							
Airport Movement Area Safety System (AMASS)	M	M	M	M	M	L	M
Precision Runway Monitor (PRM)	M	M	M	M	L	L	L
Surface Movement Advisor (SMA)	M	M	M	M	L	L	L
PROPOSED: Enhancements that are included in the MNS (Mission Need Statement) and Operational Requirements Document (ORD) for STARS but require further research and development							
Traffic Alert and Collision Avoidance (TCAS) Resolution Advisory (RA) Display	M	M	M	M	M	M	M
Surveillance System Processing Enhancements	M	M	M	L	L	M	L
Automatic Dependent Surveillance-Broadcast (ADS-B) Data Integration	M	M	M	L	L	M	L
Multisensor Fusion Tracker (MSFT)	L	L	L	L	L	L	L

Transitions and Enhancements	Metrics/ Baselines	CHI Prototypes	HITL Simulation	Task & Workload Analysis	Work-station Integration	Trade-Off Analyses	Program Documentation
Conflict Alert/Mode C Intruder (CA/MCI) Performance Enhancements	M	M	M	M	M	M	M
Flight Data Input/Output (FDIO) Integration into STARS	L	M	M	L	L	L	L
Flight Data Processing (FDP) Upgrade	L	L	L	L	L	L	L
STARS/STARS Interface	L	L	M	M	H	M	L
Free Form Text	L	L	M	L	L	L	L
Terminal Controller Position (TCP)-Defined Airspace	L	L	M	L	L	L	L
Weather Enhancements	L	L	M	L	L	L	L
Enhanced Traffic Management System (ETMS Upgrade)	L	L	M	L	L	L	L
Incorporate ASR-9 Remote Control into STARS	L	L	M	L	L	L	L

Section 15
Test Script for the STARS MCW CHI Evaluation

	Test Script for the STARS MCW CHI Evaluation
1.1	Change operational ATC system time to 1450.
1.2	Initiate all system recorded data.
1.3	Place a Terminal Controller Workstation (TCW) in the test state via the Monitor and Control position.
1.4	Perform a diagnostic on the selected TCW via the Monitor and Control position.
1.5	Demonstrate the diagnostic data is presented in a form that is immediately usable.
1.6	Place the selected TCW into the operational state via the Monitor and Control position and point to status change indication.
2.1	Select manual transition from offline state to online state for the STARS Central Support Complex external interface.
2.2	Switch the SCSC interface to offline state.
2.3	Initiate diagnostic tests on the STARS Central Support Complex external interface in the offline state.
2.4	Demonstrate that diagnostic data from an interface in the offline state is only available at the MCP and terminate diagnostics.
3.1	Disable the flow of data from the radar external interface.
3.2	Enable the data flow from the radar.
3.3	Switch the radar interface to the offline state and demonstrate that data from an interface in an offline state is only available at the MCP.
3.4	Switch the radar interface to the online state and demonstrate that data from an interface in online state is distributed to air traffic positions and the MCP.
4.1	Exclude the radar site from calculation of registration and collimation.
4.2	Initiate calculation of collimation and registration correction factors and point to the results of automatic calculation of registration and collimation factors.
4.3	Manually enter registration and collimation factors for a radar and select system generated registration and collimation factors for a radar and manually entered factors for a radar.

5.1	Enable and disable the ringaround beacon target suppression for the radar by range and azimuth.
5.2	Enable and disable the reflected beacon target suppression for the radar by range, and azimuth.
6.1	Switch three unmanned TCWs to the offline state from the MCW
6.2	Warm-start one of the selected TCWs from the MCW
6.3	Cold-start a second selected TCW from the MCW
6.4	Display a list of the comprehensive diagnostic tests and initiate one test on the third selected TCW.
6.5	Display state of the three selected TCWs.
7.1	Verify periodic online verification tests are displayed. • Parameters of the hardware component are within adaptable operating ranges. • Corruption of operational software has not occurred since loading. • All software components have consistent release levels for the operational and backup software.
7.2	Change the frequency of periodic background tests to any value within an adaptable range.
8.1	Initiate verification tests for an online processor in the surveillance thread and point to the display of verification test results.
9.1	Initiate system certification tests for the online units and verify tests for each resource are performed.
9.2	In the test report, results point to • Inclusion of summary of results; • Which resources passed, which failed, and which failed to respond; • Results are time and date stamped; • Display system certification test report.
10.1	*(Cue Satellite position to select ESL)*

11.1	Initiate automatic service certification on the FSL and ESL components concurrent with air traffic operations as follows • Point to test execution using simulated radar data and flight data. • Point to test output data on a TCW.
12.1	Demonstrate that there is redundancy between auditory signal and visual displays by pointing out such displays during the emission of each of the auditory signal examples.
13.1	Start an alarm condition and demonstrate the resetting of the aural and visual alarm conditions.
13.2	Start an alarm condition and demonstrate that it is adaptable in frequency, modulation, and duration.
13.3	Start an MSAW alarm condition and then start a CA alarm.
13.4	Start an alarm condition and demonstrate the resetting of the aural alarm independent of the visual alarm reset.
13.5	Demonstrate that the volume of an auditory alarm can be adjusted between a minimum and a maximum level.
13.6	Demonstrate that each auditory alarm is indicative of the same condition or information.
14.1	Replace a data entry device on a workstation and point out that nothing outside of the workstation must be restarted or reloaded.
15.1	Update a data field and provide the activities as follows: • Point out the propagation of the data change(s) to all affected views. • Point out the feedback to keystrokes and other data entry actions. • Point out upper and lower case equivalence.
16.1	Enter a non-destructive command and point out the capability to complete the command from a single device.
16.2	Enter a non-destructive command and point out the capability of the operator to confirm input data.

16.3	Enter a command and point out the capability of the operator to clear a command under composition.
16.4	Enter a non-destructive command and point out the capability of the operator to modify a command under composition.
16.5	Enter a non-destructive command and point out the clearing of feedback upon acceptance.
16.6	Enter a command and point out the clearing of command composition data upon selection of a function key.
17.1	Demonstrate that the movement of the pointer device is translated to control cursor movement.
17.2	Demonstrate the use of a pointer device for the selection of displayed object(s).
17.3	Demonstrate the use of a pointer device for the selection of parameters and execution of commands.
17.4	Demonstrate the feedback provisions of a pointer device. For example, is feedback provided to indicate which object would be selected when the pointer device was used to select a parameter or execute a command?
18.1	Select the cursor control mechanism and demonstrate the features of the control algorithm (i.e., speed).
18.2	Enter the appropriate command and demonstrate the repositioning of the cursor to an adapted or “home” position.
18.3	Demonstrate the correlation between direction of movement of the pointer device and the direction of movement of the cursor.
18.4	Demonstrate the adaptability of the pointer device for use by either right or left handed operators.
19.1	Demonstrate that there is a physically separate set of numeric keys per MIL-STD-1472D by pointing out a physically separate set of numeric keys.
19.2	Demonstrate the hard function key characteristics by pointing out the hard function key labels.

19.3	Point out how the soft function key is labeled with its current function and how it is programmed by the operator.
19.4	Demonstrate that the ENTER key is accessible without excessive movement.
20.1	Enter data that are too long for an input field and point out the insufficient space indications.
20.2	Either type in or bring up a list of items.
21.1	Suppress a view and point out how the system represents the suppressed view.
21.2	Resize a view and point out the size of the characters and symbols.
21.3	Resize a radar data view (go from 60 nautical miles to 20 nautical miles).
22.1	Call up a display that is longer than the display area and/or is multiple pages and point out the manner in which the position indication is depicted.
22.2	Call up a view and point out how the view is uniquely identified.
22.3	Call up a multiple page view and point out how each page is fully labeled.
23.1	Demonstrate two examples (two data classes) of how information coding techniques are used for discrimination among data classes.
23.2	Demonstrate two examples of shape coding.
23.3	Demonstrate two examples (two views) of how consistent coding conventions are used.
23.4	Demonstrate two examples (two data classes) of how redundant coding techniques are used for warnings.
23.5	Demonstrate that the same color coding scheme is used in all applicable views.
23.6	Demonstrate a time-critical event and point out use of blinking or flashing.
23.7	Demonstrate that acknowledgment of a blinking event terminates the blinking or flashing.
23.8	Demonstrate that the blink or flash rate is “on” for a period at least as long as the “off” period and that the rate is adjustable.
23.9	Demonstrate that brightness coding is adaptable.
23.10	Demonstrate two examples of size coding and show that the size is adaptable.
24.1	Display the minimum character size.

24.2	Disable a menu option and demonstrate how information coding represents this unavailable option.
24.3	Demonstrate ability to adapt the order of menu items.
25.1	Enter a destructive command and demonstrate the characteristics of this action as follows: • Point out the statement of consequences of this action, and • Point out the need for positive confirmation for destructive command/actions such as deleting a file.
25.2	Demonstrate system ability “time-out” and change length of time needed to “time-out.”
26.1	Demonstrate the use of a pointer device in selecting context sensitive menus.
27.1	Call up an MCP display and demonstrate the characteristics as follows: • Demonstrate moving a view, • Demonstrate resizing a view, and • Point out the opaque nature of the view.
28.1	Call up multiple views and point out the unrestricted display of multiple view types and display locations.
29.1	Service certification test should complete execution automatically and observe completion of service certification within 45 minutes of initiation.
30.1	Observe display of certification report to occur within 5 minutes of completion of the certification test and display of each service certification test report.
30.2	In the service certification test report point to: • Inclusion of summary of results, • Deviation from the predefined expected results, • Which tests passed or failed, and • Results are time and data stamped.

Section 16
Data Collection Sheet for the MCW FSL System CHI Evaluation

Instructions for the MCW FSL System CHI Evaluation

Directions: This form is to be completed by all members of the CHI Evaluation Team. It is to be used as the script is performed on the FSL system. The table below provides a description of what information is provided in each field. Those items in **bold** are to be completed by the CHI Review Team member.

Field	Information
Team Member	**CHI Review Team member's name.**
System	The system that is being reviewed (FSL).
Version No.	The version number of the FSL software being reviewed.
Date	**The date of the review.**
Time	**The time that the review is commenced.**
Script	The script step number that resulted in the comment from the original evaluation.
Item	The item number assigned to the issue by the original review. The numbers range from 1 to 45, because there were a total of 45 issues identified in the first review of the FSL system. The numbers are out of sequence because the data collection form is ordered by script step number.
Priority	The priority assigned to the issue by the first CHI review team (high, medium, or low).
Comment from preliminary report (April 1997)	The comment forwarded by the original CHI Review Team.
Comment for follow-up evaluation	**This is provided to record your observations as the script is performed.**
Additional Comments	**This space is provided at the bottom of each page to enter additional comments. Use this area if more space is required to provide detail on an item or if there was no comment provided for a particular step in the script from the original evaluation.**

Team Member: _____	**System** : FSL **Version No**.: _____	**Date**: _____ **Time**: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
General	13	Medium	Labels on working positions change based on assigned airspace (for example, DR/D6 instead of TCW 1). This requires M&C operators to perform mental operations to identify workstations, and may be particularly bothersome when switching from FSL to ESL (ESL always uses TCW number).	
General	15	Medium	The Cancel function does not perform the same in all windows. On some windows it closes the window, but for others it clears the values in the window with the current focus. Also, cancel function is only available in some "modification" windows and not others.	
General	22	Low	System VSP Control contains a long scrolling list that appears to include functions not required by an M&C operator.	
General	23	Low	The method for modifying parameter values is inconsistent. Some functions have a separate window for making modifications and others do the modification inside the active window.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
General	24	Low	Users have to do too many actions to complete an activity. Once a modification is made and a change is accepted the user must still click an exit to get out of the window.	
General	31	Low	Mouse click response time slow. There is a delay of acceptance when the mouse is clicked on the exit button in a window. If the mouse is moved out of the window too fast, the action is not accepted.	
General	40	Low	Labeling: • Missing labels. Some groups and items are missing labels, for example, the data recorders and LAN lines. • Label location. Labels are not located in a consistent manner. • Not all labels are unique. The primary and redundant RDAs (A or B) and Local MCW (1 or 2) systems are labeled identically and the user must look to the button to determine which system it represents.	
General	42	Low	The flash rate of blink coding is not adaptable.	
General	43	Low	The brightness coding of displayed objects is not adaptable.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
1.1	1	High	There are at least 17 different codes (consisting of combinations of color, blinking, and location) used on the main page of the FSL. There are 12 colors used (Page 18 of manual). There are also at least three further color codes for lettering in windows. There are also two window boundary color codes to indicate if the user has control over the window. There is color coding in data entry fields to indicate whether entry is allowed, not allowed, or incorrect. Some of the color contrast (letters on buttons) may be inadequate (e.g., yellow on green for TCW failure). There are too many codes for the operator to learn and use and could lead to confusion and errors.	
1.1	18	Medium	When entering data in fields, there are no guidelines for format. For example, when entering date and time, there is no indication whether colons or slashes are needed. There is also no indication in other entry fields regarding limitations on the size of the entry (such as for log in). This may lead to unnecessary confusion and errors.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
1.2	2	High	There are three types of user interfaces in the FSL: a click-and-point, pull-down menu, and button interface, a simpler key-controlled interface, and a UNIX command window. This requires the user to learn too many interaction styles and is not consistent. The UNIX windows in particular require very complex command syntax. Example: To launch diagnostic tests users must enter several commands using UNIX command language, which requires extensive training (1472D, Table XXVIII). Once the diagnostic program is launched, the user must switch from using UNIX command language and begin using tabs and the space bar to navigate menus.	
1.2	19	Medium	To place a TCW in the test state, assigned airspace must be moved to another station; the TCW must be placed in offline maintenance mode; and a UNIX window opened and the testing software launched. This procedure involves multiple steps and doesn't provide guidance. For example, if the user attempts to take the TCW offline before reassigning airspace, the 'Offline Maintenance' option is dimmed, but no indication is provided as to how to remove the workstation for maintenance.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
1.3	1	High	There are at least 17 different codes (consisting of combinations of color, blinking, and location) used on the main page of the FSL. There are 12 colors used. (Page 18 of manual). There are also at least three further color codes for lettering in windows. There are also two window boundary color codes to indicate if the user has control over the window. There is color coding in data entry fields to indicate whether entry is allowed, not allowed, or incorrect. Some of the color contrast (letters on buttons) may not be sufficient (e.g., yellow on green for TCW failure). This is too many codes for the operator to learn and use and could lead to confusion and errors.	
1.3	6	High	Some text display windows have white lettering on a gray background. There may not be sufficient contrast for reading.	
1.3	38	Low	Tabular data displays: • Tables do not have consistent text justification. Some columns are left-justified, some are right-justified, and some are centered (e.g., RTQC Registration Control Report window). • Some columns are not evenly spaced (e.g., System VSP Control window). • Some column headings are crowded together, such as "1/512NM."	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
1.4	2	High	There are three types of user interfaces in the FSL: a click-and-point, pull-down menu, and button interface, a simpler key-controlled interface, and a UNIX command window. This requires the user to learn too many interaction styles and is not consistent. The UNIX windows in particular require very complex command syntax. Example: To launch diagnostic tests, users must enter several commands using UNIX command language, which requires extensive training (1472D, Table XXVIII). Once the diagnostic program is launched, the user must switch from using UNIX command language and begin using tabs and the space bar to navigate menus.	
1.4	4	High	There is no indication of processing status. For example, several minutes may be required for some diagnostic routines. There is no way for the user to know how much time has elapsed. There may also be no indication that the system is in a diagnostic mode. When analysis is being conducted, there is no feedback to notify user that analysis has been completed.	
1.4	21	Medium	When you resize a window, data is not resized, most of the data are cropped. Maximization of diagnostic window did not provide for an increase in font size.	
1.4	44	Low	When running diagnostics, button color remains the same.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
1.6	20	Medium	Abbreviations such as "POS" are used in several windows, response messages, and tabular displays. This requires the user to remember abbreviations. There often appears to be room for full spelling out of the label.	
3.1	1	High	There are at least 17 different codes (consisting of combinations of color, blinking, and location) used on the main page of the FSL. There are 12 colors used (Page 18 of manual). There are also at least three further color codes for lettering in windows. There are also two window boundary color codes to indicate if the user has control over the window. There is color coding in data entry fields to indicate whether entry is allowed, not allowed, or incorrect. Some of the color contrast (letters on buttons) may be inadequate (e.g., yellow on green for TCW failure). There are too many codes for the operator to learn and use and could lead to confusion and errors.	
3.1	14	Medium	The lines below the Radar Link buttons (in Radar Link window) which indicate status of incoming radar links are not labeled. When viewing the status of a radar link the meaning of the two vertical lines is not apparent.	
3.1	26	Low	Window Titles • Windows have two titles. One on the top border, and one inside the window. • Some windows have two titles are not the same. • Not all window titles are in title case. Some words in a title start with lower case letters.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
3.1	27	Low	There is no way to distinguish between manual data entry boxes and those with a drop-down menu. The pop-up menu and manual entry provide no indication which type of entry is required. Without distinguishing features, the operator may not be able to tell which kind of data entry is permitted, leading to unnecessary actions and errors.	
3.1	30	Low	After changing a setting in the system, a warning window often appears stating "Configuration will change!" This is not very informative and does not request a confirmation of the previous entry.	
3.2	28	Low	Response message areas are sometimes unnecessarily large. Response messages are sometimes in mixed case, sometimes upper case. This could be understood to indicate different types of messages.	
3.4a	9	High	Color of radar link button did not change to red even though there was a critical failure. Removing of a single FSL LAN connection was not detected by the MCW. Removing both FSL LAN connections changed the color of the icon to flashing red and light green. Thus, it is possible to lose critical resources without an indication in the MCW.	
4.1	3	High	The settings for the audible alarm range from 0 to 255. The units are arbitrary. The alarm volume can be turned to zero volume, which means the user may not be notified of an emergency.	
4.1	10	High	Audible alarms do not discriminate between alarm conditions. The same auditory alarm is used for all types of alarms and for other informational messages.	

Additional Comments:

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
4.1	32	Low	In the "Tile Modification" window, there are two initial selectable options. If the wrong one is chosen, the user must close and reopen the window in order to make a new selection. This adds unnecessary steps to the interaction.	
4.1	41	Low	Data entry fields behave differently but appear the same. Some fields accept manual text entry, whereas others only accept preselected entries from a pop-up menu.	
4.1	45	Low	Window labels are color coded, but not consistently. White labels are used for fields that allow text entry. Blue labels are used for fields which have information filled automatically by the system. However, sometimes blue labeled fields are editable (e.g., Tile Modification).	
6.2	11	High	Some actions do not provide feedback when the user reconfigures a screen.	
6.3	8	High	There is no online help system available.	
6.3	36	Low	UNIX commands are required to log in to remote TCWs. The alias that is available to terminate remote processing (cds/killall) is nonfunctional. Super user rights are needed to terminate and restart the processes in the remote TCW.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
6.4	2	High	There are three types of user interfaces in the FSL: a click-and-point, pull-down menu, and button interface, a simpler key-controlled interface, and a UNIX command window. This requires the user to learn too many interaction styles and is not consistent. The UNIX windows in particular require very complex command syntax. Example: To launch diagnostic tests users must enter several commands using UNIX command language, which requires extensive training (1472D, Table XXVIII). Once the diagnostic program is launched, the user must switch from using UNIX command language and begin using tabs and the space bar to navigate menus.	
7.1c	25	Low	Software put in separate directories (UNIX level). Releases can be seen by UNIX command.	
7.1	37	Low	One of the main commands, "Authorization," has no sub-menus and is not consistent with the others.	
12.1	10	High	Audible alarms do not discriminate between alarm conditions. The same auditory alarm is used for all types of alarms and for other informational messages.	
13.1	3	High	The settings for the audible alarm range from 0 to 255. The units are arbitrary. The alarm volume can be turned to zero volume, which means the user may not be notified of an emergency.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
13.1	17	Medium	In the Tile Modification window, the user tried to modify a value before disabling MSAW. The data entry field turned red, but there was no information as to the nature of the error.	
13.1	19	Medium	To place a TCW in the test state, assigned airspace must be moved to another station; the TCW must be placed in offline maintenance mode; and a UNIX window opened and the testing software launched. This procedure involves multiple steps and doesn't provide guidance. For example, if the user attempts to take the TCW offline before reassigning airspace, the 'Offline Maintenance' option is dimmed, but no indication is provided as to how to remove the workstation for maintenance.	
13.1	33	Low	Unnecessary information is displayed. For example, the XY coordinates of windows are shown as they are moved.	
13.1	35	Low	It may be possible for a specialist to log in at a supervisory level and be vulnerable to having someone else log in at a lower level, thus revoking the earlier log-in. This might prove confusing if several people are using the system concurrently. Some commands seem to be available even though they cannot be accessed at the current log-in level. This might lead to confusion regarding system operation.	
13.1	39	Low	System Messages (located at the top of the monitoring screen) are not labeled.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
13.3	10	High	Audible alarms do not discriminate between alarm conditions. The same auditory alarm is used for all types of alarms and for other informational messages.	
13.4	10	High	Audible alarms do not discriminate between alarm conditions. The same auditory alarm is used for all types of alarms and for other informational messages.	
15.1	12	Medium	When in a UNIX console window, it is not possible to erase an entry by backspacing over it. This would make it difficult for the user to correct command entries.	
18.1	34	Low	In VSP and other similar windows, a list of accessible control items is shown. Selecting one of these brings up another window where only one value can be changed. Creates unnecessary interactions.	
20.1	29	Low	The system beeps when an out-of-range value is entered (sometimes). Sometimes, when an ineligible entry was given (e.g., "c" when only "a" or "b" were options) the system would beep after "Modify" was clicked or the "Enter" key was pressed. There appeared to be some inconsistency to the range checking /feedback process.	
21.2	21	Medium	When you resize a window, data is not resized, most of the data is cropped. Maximization of diagnostic window did not provide for an increase in font size.	
22	18	Medium	When entering data in fields, there are no guidelines for format. For example, when entering date and time, there is no indication whether colons or slashes are needed. There is also no indication in other entry fields regarding limitations on the size of the entry (such as for log in). This may lead to unnecessary confusion and errors.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
23	16	Medium	The area showing the number of unacknowledged messages at the top of the main window shows red flashing with an audible alert if a catastrophic message has been received. It shows gray for other error messages. This coding may not be clear about the status or presence of error messages that are not catastrophic failures.	
23.1	14	Medium	The lines below the Radar Link buttons (in Radar Link window) which indicate status of incoming radar links are not labeled. When viewing the status of a radar link the meaning of the two vertical lines is not apparent.	
23.6	7	High	Alarm message acknowledgment is awkward. Messages can be acknowledged all at once, page-by-page from the "Messages" window, or one at a time in message box (main display). When the user acknowledges all alarms, it could result in confusion over which message produced the alarm. The user must open the messages list and read through the messages to determine which is responsible. This list does not aid the user in identifying the source of the alarm. From the main monitoring window users can only view 1 message at a time. This message must be acknowledged in order to move to the next message. Users may be forced to acknowledge several less important alarms (without being able to take action) in order to reach a critical alarm. It is likely that important information could be inadvertently lost.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
23.6	9	High	Color of radar link button did not change to red even though there was a critical failure. Removing of a single FSL LAN connection was not detected by the MCW. Removing both FSL LAN connections changed the color of the icon to flashing red and light green. Thus, it is possible to lose critical resources without an indication in the MCW.	
23.8	7	High	Alarm message acknowledgment is awkward. Messages can be acknowledged all at once, page-by-page from the "Messages" window, or one at a time in message box (main display). When the user acknowledges all alarms, it could result in confusion over which message produced the alarm. The user must open the messages list and read through the messages to determine which is responsible. This list does not aid the user in identifying the source of the alarm. From the main monitoring window users can only view 1 message at a time. This message must be acknowledged in order to move to the next message. Users may be forced to acknowledge several less important alarms (without being able to take action) in order to reach a critical alarm. It is likely that important information could be inadvertently lost.	
24	5	High	In the UNIX console window, it may be possible to execute destructive commands, such as a disk format. Errors in command entries could involve loss of data or system function.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April 1997)	Comment for follow-up evaluation
25.1	5	High	In the UNIX console window, it may be possible to execute destructive commands, such as a disk format. Errors in command entries could involve loss of data or system function.	

Additional Comments: _____

Section 17
Data Collection Sheet for the MCW ESL System CHI Evaluation

Instructions for the MCW ESL System CHI Evaluation

Directions: This form is to be completed by all members of the CHI Evaluation Team. It is to be used as the script is performed on the ESL system. The table below provides a description of what information is provided in each field. Those items in **bold** are to be completed by the CHI Review Team member.

Field	Information
Team Member	**CHI Review Team member's name.**
System	The system that is being reviewed (ESL).
Version No.	The version number of the ESL software being reviewed.
Date	**The date of the review.**
Time	**The time that the review is commenced.**
Script	The script step number that resulted in the comment from the original evaluation.
Item	The item number assigned to the issue by the original review. The numbers range from 1 to 21, since there were a total of 21 issues identified in the first review of the ESL system. The numbers are out of sequence because the data collection form is ordered by script step number.
Priority	The priority assigned to the issue by the first CHI review team (high, medium, or low).
Comment from preliminary report (April 1997)	The comment forwarded by the original CHI Review Team.
Comment for follow-up evaluation	**This is provided to record your observations as the script is performed.**
Additional Comments	**This space is provided at the bottom of each page to enter additional comments. Use this area if more space is required to provide detail on an item or if there was no comment provided for a particular step in the script from the original evaluation.**

Team Member: _____	**System** : ESL **Version No.**: _____	**Date**: _____ **Time**: _____

Script	Item	Priority	Comment from preliminary report (April '97)	Comment for follow-up evaluation
General	6	High	Compromised systems were represented by changes in color and icon. However, the meaning of the colors was unclear, and software and hardware failures resulted in presentation of the same icon. When a workstation represented in blue was shut down, the monitoring screen did not indicate the loss of the workstation. (When repeated for a working [green] workstation the icon did change to red.) Warning status show inconsistent information at the next level. (Sometimes, only red and green status appear and sometimes red and yellow status are displayed)	
General	9	High	During an alarm condition the user must go to the messages list and read through the TV Monitor list to determine which message is responsible. This list does not aid the user in identifying the source of the alarm.	
General	10	High	When a LAN is disconnected from a TCW, the TCW icon turns red, but it is impossible to identify which LAN failed.	
General	12	High	When starting the Startup DCP the user must deselect MCP-1 or it will also restart the workstation in use.	
General	14	Medium	There are many abbreviations. This requires the user to memorize a lot of information to use the system.	
General	18	Low	The "select a drive" option can be accessed anywhere within the window and it doesn't do anything.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April '97)	Comment for follow-up evaluation
1.1	19	Low	Passwords can be turned off, which means users can change password without knowing the old password. (This option can be disabled.)	
6.1	4	High	The system uses inconsistent user interface input methods. The ESL system provides GUI, character-based menu, and UNIX interfaces. Main ESL controls are dispersed among 3 windows (control menu, TV monitor, and consoles).	
6.1	15	Medium	Some terminology is not used consistently. For example, TCWs are referred to inconsistently - sometimes they are referred to as OCP and on other occasions they are called TCWs. To take a TCW offline (or to put one back online) the user must choose a menu option – "Exit OCP" - from the Control menu window.	
6.1	17	Medium	The object selection process is too cumbersome and induces errors. Too many steps are required to get status information. To get status information about a particular OCP the user must first left click on the OCP icon (a right click will display a non-functional pop-up menu), then the user must right click on the icon again to get a pop-up menu from which a status option can be chosen. Error Example: It is possible to select a button with the left mouse button, point to a different button, click with the right mouse button, and get the original button's menu. This could be confusing.	
6.2	7	High	Color coding for system status includes a blue code for emergency services. This color is not generally associated with alarm conditions (not a display stereotype).	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April '97)	Comment for follow-up evaluation
6.2	11	High	No feedback was provided in response to some commands (e.g., when the DCP was restarted). Without feedback the user may repeat an action that has already been performed.	
6.5	4	High	The system uses inconsistent user interface input methods. The ESL system provides GUI, character-based menu, and UNIX interfaces. Main ESL controls are dispersed among 3 windows (control menu, TV monitor, and consoles).	
7.1c	20	Low	Software put in separate directories (UNIX level). Releases can be seen by UNIX command.	
12	3	High	It is possible to shut down the ESL software completely. This might be a problem if the operator inadvertently shuts down while in an emergency situation.	
12	11	High	No feedback was provided in response to some commands (e.g., when the DCP was restarted). Without feedback the user may repeat an action that has already been performed.	
12	21	Low	When services are disabled, buttons in the sub-menus disappear. This may prove to be disorienting for the operator.	
12.1	1	High	It is difficult for the operator to determine details of status from the main display. Though radar failed there was no indication at the top level monitoring screen since radar was coming from a second site (the workstation icon remained green). A user would have to drill down to system status to find out that data from one radar was missing. Furthermore, Radar Link status is not monitored.	
12.1	2	High	No audible alarms are used in the ESL system. If a user is distracted from the display, there is no cue to call attention back to the screen.	

Additional Comments: _____

Script	Item	Priority	Comment from preliminary report (April '97)	Comment for follow-up evaluation
13.1	1	High	It is difficult for the operator to determine details of status from the main display. Though radar failed there was no indication at the top level monitoring screen since radar was coming from a second site (the workstation icon remained green). A user would have to drill down to system status to find out that data from one radar was missing. Furthermore, Radar Link status is not monitored.	
13.1	2	High	No audible alarms are used in the ESL system. If a user is distracted from the display, there is no cue to call attention back to the screen.	
13.1	5	High	User can change display color coding and could change emergency color codes. This could lead to errors if other operators use the system.	
13.6	2	High	No audible alarms are used in the ESL system. If a user is distracted from the display, there is no cue to call attention back to the screen.	
15.1	13	High	Magnetic Offset function provides no anchors on the slide bar. There is not a method to directly type in a value.	
16.2	5	High	User can change display color coding and could change emergency color codes. This could lead to errors if other operators use the system.	
23.6	16	Medium	There is no blinking or flashing. For example: When ESL is minimized, and when a critical event arises, the color of the ESL icon changes but does not blink.	

Additional Comments:

Script	Item	Priority	Comment from preliminary report (April '97)	Comment for follow-up evaluation
25.b	8	High	Many actions submitted by the user were accepted by the system, but the action did not actually occur. For example, the user initiated a TCW restart, the system accepted and verified the command, but the TCW was not restarted.	
25.1	8	High	Many actions submitted by the user were accepted by the system, but the action did not actually occur. For example, the user initiated a TCW restart, the system accepted and verified the command, but the TCW was not restarted.	

Additional Comments: _____

Section 18
Data Collection Sheet for Both MCW Systems CHI Evaluation

Instructions for FSL / ESL Side-by-Side CHI Evaluation

Directions: This form is to be completed by all members of the CHI Evaluation Team. It is to be used as the script is performed on the side-by-side comparison of the FSL and ESL systems. The table below provides a description of what information is provided in each field. Those items in **bold** are to be completed by the CHI Review Team member.

Field	Information
Team Member	**CHI Review Team member's name.**
System	The systems that are being reviewed (Both FSL and ESL).
Version No.	The version numbers of the FSL / ESL software being reviewed.
Date	**The date of the review.**
Time	**The time that the review is commenced.**
Script	The script step number that resulted in the comment from the original evaluation.
Item	The item number assigned to the issue by the original review. The numbers range from 1 to 23, since there were a total of 23 issues identified in the first review of the FSL system. The numbers are out of sequence because the data collection form is ordered by script step number.
Priority	The priority assigned to the issue by the first CHI review team (high, medium, or low).
Comment from preliminary report (April 1997)	The comment forwarded by the original CHI Review Team.
Comment for follow-up evaluation	**This is provided to record your observations as the script is performed.**
Additional Comments	**This space is provided at the bottom of each page to enter additional comments. Use this area if more space is required to provide detail on an item or if there was no comment provided for a particular step in the script from the original evaluation.**

Team Member: _____	**System** : Both **Version Nos**.: _____ / _____	**Date**: _____ **Time**: _____

Script	Item	Priority	Comments from preliminary report (April 1997)	Comments for follow-up evaluation
General	2	High	There is not a consistent way to switch from ESL to FSL. Currently, user must minimize ESL window to return to FSL.	
General	3	High	The diagnostic routine was begun and completed, but the user was only provided with pass/fail information. The user was unable to view specific test values.	
General	4	High	When shutting down a TCW the user is not required to confirm the request.	
General	5	High	The user must use a command window (UNIX command-line interface) to perform any diagnostics. The actual diagnostic command is different on each system. The user must type the correct name of the TCW in the command. The TCW names are not the same in both systems.	
General	6	High	Visual and audible alarms are not the same. Color coding, flashing, and audible are in FSL, visual (steady color) only in ESL.	
General	7	High	The method for changing the subsystem status is not the same. For ESL, user goes to the "control menu" (a window) and chooses exit OCP, then selects TCW/OCP to be taken offline. In FSL, user clicks on TCW icon and a pop up menu appears, from which the user must select "Reconfigure", then select 'off line'.	

Additional Comments: _____

Script	Item	Priority	Comments from preliminary report (April 1997)	Comments for follow-up evaluation
General	8	High	Automatic log-off was not observed after a period of inactivity.	
General	10	Medium	Many of the functions in both systems require a UNIX command window. UNIX command-line language does not accept upper and lower case as equivalent.	
General	12	Medium	Lack of consistent labels. For example, in the FSL system, labels on working, positions change based on assigned airspace (e.g., DR/D6 instead of TCW1). This requires M&C operators to perform mental operations to identify workstations and may be particularly bothersome when switching from the FSL to ESL system (ESL always uses TCW number).	
General	19	Low	In both systems, when the cursor was placed over an object for a period of time feedback was not provided to indicate which object would be selected.	
General	22	Low	Some menu options needed ellipses "…" which indicate that another window will appear when that option is chosen.	
1.1	17	Low	Unable to change time on ESL system. Indicated that time could be done on ESL, however time can be set via a UNIX window, versus a simple procedure for the FSL system.	
1.1	18	Low	There is no easy way to change the font sizes in the window. The font size in the pull-down menus are too small and are a different size than the pop-up menus available when buttons are selected. Different fonts are used in the different CHI modes.	

Additional Comments:

Script	Item	Priority	Comments from preliminary report (April 1997)	Comments for follow-up evaluation
1.3	21	Low	Neither system provided the capability for all complete commands to be performed from a single input device. Modifying many of the parameter values required selection and entry using both the keyboard and mouse.	
6.2	15	Medium	System message window displays are dense and difficult to read, for example, the TV Monitor window.	
6.3	13	Medium	There is no simple way for the user to determine the relationship between items on the MCW displays and the operating positions on the floor. The TCW buttons on the main display are not mapped to floor locations of the workstations, and some of the positions presented don't exist.	
6.3	23	Low	The frequency, modulation, and duration of auditory alarms is not adaptable.	
13.2	23	Low	The frequency, modulation, and duration of auditory alarms is not adaptable.	
16.2	20	Low	A user is not notified that they do not have sufficient access privileges to a invoke a command until they have entered a new value and attempted to submit it to the system. For example, when the user attempted to modify a library in the FSL it allowed new data to be entered in the data entry field, and the apply button to be selected, before the user was notified they did not have write permission.	
17.3	16	Medium	For the ESL system, there is an indication of an option menu available for data field entry. However, in FSL, option menu fields look exactly the same as manual data entry fields.	

Additional Comments:

Script	Item	Priority	Comments from preliminary report (April 1997)	Comments for follow-up evaluation
18.1	14	Medium	Modification of mouse control parameters is not readily accessible to the user (cursor movement speed, double-click speed, adaptation to left or right-handed operators).	
18.4	14	Medium	Modification of mouse control parameters is not readily accessible to the user (cursor movement speed, double-click speed, adaptation to left or right-handed operators).	
21.2	11	Medium	When a user resizes views, text wraps in ESL system windows but not in FSL windows.	
21.3	9	High	Too many windows can be open at any one time and they open on top of each other. This can be very disorienting to a user. Hard to determine which windows or applications were open. No parent child relationship to windows.	
22 .3	9	High	Too many windows can be open at any one time and they open on top of each other. This can be very disorienting to a user. Hard to determine which windows or applications were open. No parent child relationship to windows.	

Additional Comments:

Script	Item	Priority	Comments from preliminary report (April 1997)	Comments for follow-up evaluation
28.1	1	High	Display formats are incompatible: • There are at least 4 different interactive styles between the two systems which requires the user to learn each system independently. Learning 4 different interactive styles could lead to inefficient operations and may result in error, especially when user is performing under high workload conditions. • Both systems allow user to open large amount of windows at once, the user can easily lose the relationship between the open windows. • When multiple windows are opened they obscure the previously opened windows because they are placed directly over them. • Color coding is inconsistent between the two systems.	
28.1	9	High	Too many windows can be open at any one time and they open on top of each other. This can be very disorienting to a user. Hard to determine which windows or applications were open. No parent child relationship to windows.	

Additional Comments:

Section 19
Supplemental Data Collection Sheet for MCW CHI Evaluation

Instructions for Supplemental Data Collection Sheet

Directions: This form will be provided to all members of the CHI Evaluation Team. It is to be used during the independent and side-by-side evaluations **as needed**. The table below provides a description of what information is to be entered by the CHI Review Team member in each field.

Field	Information
Team Member	CHI Review Team member's name.
Page	Numbered consecutively by team member.
System	The system to which comment refers (FSL, ESL, or Both).
Version No.	The version number(s) of the software on which the comment is being made.
Date	The date of the review.
Time	The time at which this form is completed.
Additional Comments	Any supplemental comments or notes that the CHI Review Team member needs to capture.

Team Member: _____	**Page: _____**
System : FSL / ESL/ Both **Version No.**: _____	**Date**: _____ **Time**: _____

Additional Comments: _____